Chapter IV:
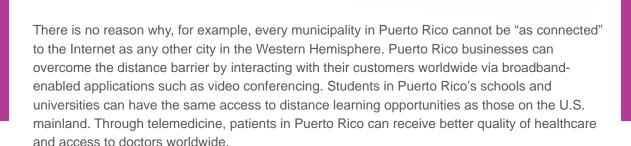# A 21st Century Broadband Infrastructure for Puerto Rico

A. Introduction

Puerto Rico needs broadband access that is fast, robust, redundant, and ubiquitous to meet the economic challenges of the twenty-first century, ensure continued competitiveness of our business community, help contain the cost of government and social services, and ensure that all Puerto Ricans continue to partake in the social discourse that is increasingly taking place online.

A robust twenty-first century island-wide broadband infrastructure is essential, in both urban and rural areas and across higher and lower income communities. A robust twenty-first century broadband infrastructure will include multiple competing networks offering both fixed and mobile broadband connections to all citizens, business, and government and community anchor institutions. A robust twenty-first century broadband infrastructure will offer fast broadband retail services aimed at all citizens and households (both fixed and mobile), and ultra-fast wholesale and retail services aimed at the business community, public safety and government facilities, and institutions including schools, libraries, hospitals, clinics, and other community anchor institutions.

A robust broadband infrastructure is essential to attract foreign direct capital that will generate the jobs and opportunities needed to sustain Puerto Rico's competitiveness. Puerto Rico recently enacted the Export Services Law that gives substantial incentives for companies to relocate offices and plants to Puerto Rico. The objective of this legislative initiative is to promote foreign investment, particularly targeting companies that provide services in industries such as aerospace, manufacturing and other high-tech industries, that will leverage the large number of well-trained, bilingual engineers and other professionals graduating from the University of Puerto Rico system. A strong broadband backbone that will allow these investors to deliver better services to clients in and out of Puerto Rico is an essential asset to ensure the success of this initiative.

The networks that support broadband service and connectivity across the island will stand as a barrier to twenty-first century growth and competitiveness if they are inadequate to meet the capacity demanded by Puerto Rico's consumers and businesses. On the other hand, with a robust broadband infrastructure, there is nothing that prevents the establishment of Puerto Rico as a key target of direct foreign investment and as the central point of broadband and information economy commerce for the Caribbean and the Southern Hemisphere.

There is no reason why, for example, every municipality in Puerto Rico cannot be "as connected" to the Internet as any other city in the Western Hemisphere. Puerto Rico businesses can overcome the distance barrier by interacting with their customers worldwide via broadband-enabled applications such as video conferencing. Students in Puerto Rico's schools and universities can have the same access to distance learning opportunities as those on the U.S. mainland. Through telemedicine, patients in Puerto Rico can receive better quality of healthcare and access to doctors worldwide.

All of this is possible.

This is the vision that the Puerto Rico Broadband Taskforce has set as a goal for Puerto Rico. To define a strategy to achieve these goals, this chapter establishes a timeline with aspirational metrics. These goals are then contrasted with the measured broadband availability across the island to identify the scope of the digital challenges faced today across Puerto Rico and help establish quantifiable milestones. Finally, it examines different strategies aimed at accelerating investment in broadband built-out across the island, and establishes a series of strategic recommendations to achieve these goals.

1. Broadband Capacity Goals for Puerto Rico

Broadband infrastructure in Puerto Rico needs to support access to residential broadband services as well as a myriad of higher capacity applications and uses demanded by Puerto Rico's businesses, government, and community institutions. The broadband needed by a small business to stay connected with customers and suppliers may necessitate different capacity and quality of service requirements than those needed to meet the usage demands of a hospital in San Juan, or an elementary school in the interior or in Vieques, or public safety needs across the island, or households across Puerto Rico. As a result, this Strategic Plan sets standards and goals for broadband infrastructure that address the capacity needs of multiple applications and uses.

Furthermore, the Puerto Rico Broadband Taskforce understands that these goals will only be achieved as private sector investors identify and pursue economic opportunity and invest in better and more infrastructure and services across the island. For this reason, a key goal of this Strategic Plan is to ensure that competition across the broadband sector thrives.

This framework of complementary broadband networks offering different capacity depending on the type of demand served is built on the foundation laid out by the FCC in the National Broadband Plan, as well as various international telecommunications institutions that are increasingly framing the broadband access challenge in this multi-layered network approach. This principle is consistent with a market driven sector where supply grows to meet demand where it emerges and as it evolves. In its National Broadband Plan, the FCC sets various broadband capacity goals depending on the intended demand and usage. These FCC standards are based on estimates of the actual capacity needs that consumers have today, given the type of institution, usage, and applications typically run through the broadband connection.

In particular, the FCC estimated the broadband capacity needed to support applications typically used by most online users. For example, while basic web-browsing or e-mail applications typically need about 0.1-0.3 Mbps actual speed connection, other applications need greater actual capacity to be viable, such as streamed classroom lectures (1-5 Mbps actual download speeds), video conference + VoIP for lower definition telemedicine (0.6 - 1.0 Mbps) or enhanced video teleconferencing (5-10 Mbps).[1] Taking into account the broadband capacity needed to deliver these applications, the typical usage patterns by online users, and consumer broadband purchasing patterns, the FCC establishes in the National Broadband Plan a National Broadband Availability Target of 4 Mbps download/ 1Mbps upload actual speeds.[2] This target broadband speed would meet the demand needs of the average consumer and can be thought of as a proposed floor – or minimum – network capacity essential to all Americans. The National Broadband Plan notes that such standards will need to be revised as consumer patterns for broadband demand change. The FCC recently created the Connect America Fund, which will subsidize the provision of broadband in areas of the United States where no broadband exists.[3] At the same time (and as discussed below), the FCC recognized the need for higher speeds in certain (yet-to-be defined) areas of the country, and additionally established that all Connect America Fund recipients discuss and incorporate the unique needs of community anchor institutions like government, schools, libraries, and hospitals in their network planning.

The people of Puerto Rico contribute to the historical Universal Service Fund, and, eventually and as it replaces the USF program, to the Connect America Fund, through regulatory fees applied to their telecommunications bills. Many of Puerto Rico's broadband providers benefit from the existing Universal Service Fund program, and are expected to partake in the newly created Connect America Fund. The standards and goals for broadband connectivity across Puerto Rico established by the Puerto Rico Broadband Taskforce take this reform into account to ensure consistency.

By 2015, 98% of all households should have broadband available at actual minimum speeds of 4 Mbps download /1 Mbps upload.

While the FCC National Broadband Availability Target establishes a de facto minimum capacity goal over the coming years, the FCC set in the National Broadband Plan higher aspirational goals for broadband capacity to most citizens. These goals recognize that across many metropolitan and suburban areas across the U.S. where the competition is thriving and investment is readily flowing, this minimum capacity standard has already been met and greatly surpassed. As a result, the National Broadband Plan established aspirational capacity goals of at least 100 million U.S. homes with affordable access to actual download speeds of at least 100 Mbps and actual upload speeds of at least 50 Mbps by 2020. It also establishes a milestone that by 2015, 100 million homes should have affordable broadband access to actual download speeds of 50 Mbps and actual upload speeds of 20 Mbps.[4] Further, the National Broadband Plan called for the U.S. to lead the world in mobile innovation with the fastest and most extensive wireless network of any nation, and establishes recommendations to reach this goal and accelerate deployment of 3G mobile networks where it is lacking and the deployment of new 4G technology across the country. The National Broadband Plan further sets a goal of 1 Gbps connectivity for community anchor institutions such as schools, hospitals, and government institutions.[5]

Taking into account these rich precedents as well as the current state of broadband networks across Puerto Rico, the Puerto Rico Broadband Taskforce establishes the following goals over the coming decade for a robust broadband infrastructure across Puerto Rico:

Strategic Goals for Puerto Rico - Access

All urban areas across Puerto Rico should have available ubiquitous broadband infrastructure able to provide service at speeds, and quality of service comparable to that available in any city in the Western Hemisphere. All citizens across Puerto Rico, in both urban and rural areas, should have available ubiquitous broadband service meeting a minimum speed standard. Similarly, mobile broadband technology should continue expanding and ensure rapid expansion of next generation services across the island. Such service should be accessible to all residential, commercial and, or government customers.

Fixed Broadband Capacity Goals:
* By 2015, 98% of all households should have broadband available at actual minimum speeds of 4 Mbps download (DL)/1 Mbps upload (UL) at affordable prices to allow for at-home web 2.0 service offerings such one-way video streaming applications and two way video conference and collaboration applications.
* By 2015, all urban locations and 50% of all rural and remote areas should have access to broadband actual speeds of at least 10 Mbps DL/3 Mbps UL at affordable prices; 70% of urban locations should have access to at least 25 Mbps DL/10 Mbps UL, and 50% of urban locations should have access to at least 50 Mbps DL/10 Mbps UL.

- By 2015, across the island the average capacity available across all fixed broadband service offerings, provided through wireline or fixed-wireless networks, should be no less than 6 Mbps download speeds.
- By 2020, at least 85% of all customers should have access to at least 100 Mbps DL/50 Mbps UL.
- By 2015, average latency for IP traffic which originates and terminates in Puerto Rico should be no greater than 20 milliseconds; average latency for IP traffic which originates in Puerto Rico and terminates in the southeast coast of the U.S. mainland should be no greater than 90 milliseconds.

Mobile Broadband Capacity Goals:
- Mobile broadband offerings at next generation speeds will be available across at least 98% of the island's geography where the population resides by 2015. Expansion of smart phone penetration and tablet end-user devices will be promoted.

Connectivity Across Community Anchor Institutions:
- By 2015, higher education, K-12 schools, and healthcare institutions across all urban and rural areas should have access to 100 Mbps DL/25 Mbps UL speeds to sustain virtual community learning and telemedicine.
- By 2020, higher education, K-12 schools, and healthcare institutions across all urban and rural areas should have access to 1 Gbps speeds to sustain virtual community learning and telemedicine.

Broadband Submarine and Backhaul Network Security:
- Puerto Rico broadband providers and local and national government officials will work together to derive a plan to improve the security, robustness, and redundancy of the backhaul broadband infrastructure across the island. Particular emphasis will focus on the security standards of alternative submarine cables, and strategies to encourage the underground construction of backhaul infrastructure across the island.
- A more robust backhaul and underwater cable infrastructure will support the expansion of Puerto Rico as a telecommunications and data hub for the Hemisphere.

Competition across the Broadband Service Market:
- By 2015, 98% of Puerto Ricans will have at least three competitive broadband offerings available.

Achievement of these goals will enable continued improvement of Puerto Rico within international rankings of ICT services by entities such as the World Bank and the World Economic Forum. In 2012 Puerto Rico made a significant gain, now 2nd in the region, elevating from a 43rd to 36th ranking on The Global Information Technology Report 2012, Network Readiness Index (NRI).[6] Such rankings matter a great deal to companies assessing where to locate new expansions or initiatives. Hence, these advancements are important to improve Puerto Rico's competitiveness and promote relocation of companies to Puerto Rico.

Across Puerto Rico, 14% of households, or approximately 177,000, lack any form of fixed broadband

B. The Broadband Infrastructure Challenge in Puerto Rico

As the previous chapter describes in detail, thanks to the federally funded State Broadband Initiative program, there is timely data available to assess Puerto Rico's progress toward these goals. However, more information will need to be collected and analyzed over the next ten years to continue to mark progress on meeting all of these goals. This segment summarizes the information available today to assess the access challenge, and identifies gaps in necessary data to track progress and assess the completion of strategic milestones.

1. Access Challenge - Fixed and Mobile Infrastructure

The previous chapter summarized the data available today regarding the state of the broadband landscape in Puerto Rico. Based on the broadband inventory data collected from service providers across Puerto Rico by Connect Puerto Rico, it is evident that Puerto Rico's broadband infrastructure is markedly inadequate to meet the increasing needs for capacity of consumers, businesses, and institutions, and significantly lagging behind most jurisdictions across the U.S., and other regions. Table IV.1 restates the data presented in Chapter III summarizing broadband availability by speed tier as of June 2011.

Table IV.1 - Broadband Availability by Fixed Networks Across Puerto Rico - by Speed Tier	
Download/Upload Speed Tiers	Percent Households Served
At least 768 Kbps/200 Kbps	86%
At least 1.5 Mbps/200 Kbps	85%
At least 3 Mbps/768 Kbps	57%
At least 6 Mbps/768 Kbps	41%
At least 6 Mbps/1.5 Mbps	34%
At least 10 Mbps/768 Kbps	32%
At least 25 Mbps/768 Kbps	0.00%
At least 50 Mbps/768 Kbps	0.00%
At least 100 Mbps/768 Kbps	0.00%
At least 1 Gbps/768 Kbps	0.00%

Source: Connect Puerto Rico, June 2011

This infrastructure is markedly insufficient to sustain the growing demand of businesses, citizens, schools, hospitals, or government for broadband connectivity and speed and falls far short of most basic capacity goals set in this Strategic Plan for 2015. Based on Connect Puerto Rico data, as of June 2011, between 34% and 57% of households across Puerto Rico did not have access available at the minimum target speeds capacity of 4 Mbps download (DL)/1 Mbps upload (UL).[7] A core goal of this Strategic Plan is to close this significant access gap by ensuring broadband access at this capacity or higher to 98% of Puerto Rico households by 2015.

Approximately 43% of households lack broadband at 3 Mbps/768Kbps, speeds necessary to run applications increasingly demanded by online users.

By contrast, data obtained from Puerto Rico's mobile providers indicates that mobile broadband access across much of the island already meets the strategic goals set in this Plan, and surpasses estimates across the U.S. and the goals set by federal policy makers. As of June 2011, 99% of areas where households are located had broadband access available from at least one mobile broadband provider. By contrast, the National Broadband Map estimates that approximately 97% of U.S. households have access to at least one mobile broadband network.

2. Competition

As of June 2011, there were multiple competing broadband providers throughout Puerto Rico including 8 fixed broadband providers serving residential customers, 3 cable modem providers, 1 DSL island-wide provider, and at least 5 fixed wireless providers. Furthermore, there were 5 mobile broadband providers serving the great majority of the populated areas across Puerto Rico. Supporting the retail networks of all of these providers and, in certain areas offering retail service to customers, there are 11 broadband backhaul or middle-mile providers in Puerto Rico.

While these data indicate a degree of competition in broadband service across Puerto Rico, the data is insufficient to ascertain actual competition across the island. The level of competition across the island will depend on the degree of overlap and redundancy of alternative networks and the market strategies of broadband providers across different segments of the broadband market. To assess competition, it will be necessary to determine what competing alternatives are available to most Puerto Rican households, citizens, businesses, and institutions. Table IV.2 estimates the degree of penetration of various retail technology platforms across Puerto Rico. These data indicate that, relative to comparable mainland U.S. data available, platform penetration in Puerto Rico is lagging. As such, inter-platform and inter-carrier competition across Puerto Rico is likely lagging behind comparable areas in the rest of the U.S. Further research will be necessary to ascertain the level of competitive options availability to most Puerto Rico broadband consumers.

Table IV.2 - Availability by Broadband Platform - Puerto Rico & U.S. Comparisons
At least 768 Kbps Download/200 Kbps Upload

	Percent of Households Served	
Platform Type	**Puerto Rico Estimates**	**U.S. Estimates**
Cable	79%	85%
DSL	64%	88%
Fixed Wireless	40%	31%
Mobile	99%	97%

Source: For Puerto Rico estimates, Connect Puerto Rico, June 2011. For U.S. estimates, National Broadband Map, NTIA, December 2010 (which is the latest data available at the national level).

> **Recommendation**:
> Puerto Rico should continue to collect and analyze data on broadband infrastructure availability, capacity, and competition over the next decade to assess progress in meeting the Strategic Plan's goals.

C. Strategies to Promote Investment in Broadband Capacity Across Puerto Rico

The broadband availability gap across Puerto Rico is an essential competitive challenge that necessitates a coordinated effort involving both public and private stakeholders. Achieving the infrastructure and speed goals set out in this Strategic Plan will require a significant increase in capital investments over the coming decade. This section first examines the impact across Puerto Rico of the FCC's Universal Service Fund reform underway. It then addresses proposed strategies to enhance the economics of broadband and promote investment in broadband capacity across Puerto Rico.

1. FCC Universal Service Fund Reform - Impact Across Puerto Rico

In October 2011, the Federal Communications Commission adopted a sweeping reform of the federal Universal Service Fund's (USF) High-Cost program that transitions it to a broadband-oriented structure. The reform establishes a transition of the High-Cost program, historically aiming to support voice-telephony service in rural and remote areas where market forces – left to their own devices – will not provide service, to a Connect America Fund that will aim to subsidize broadband infrastructure.[8] This reform will impact Puerto Rico's broadband sector in a number of ways. Private and public stakeholder members of the Puerto Rico Broadband Taskforce have monitored this reform as it unfolded, and sought to work collaboratively with the FCC to ensure a fair and effective allocation of subsidies to unserved areas in Puerto Rico under the new Connect America Fund.

The USF program is managed by the FCC and historically aimed to subsidize traditional voice telephony network build-out and services (a) across rural and remote areas; (b) across education, libraries or healthcare institutions; and (c) among low-income households. The fund is financed through a regulatory fee imposed by the FCC on all telecommunications providers and is passed on to consumers through a regulatory fee on their telecommunications services bill of approximately 15% in 2010. The size of the USF program in 2010 amounted to approximately $8.4 billion.[9] The historical USF program is comprised of four components, including:

- **High Cost Program**: This support ensures that consumers in all regions of the nation have access to and pay rates for telecommunications services that are reasonably comparable to those in urban areas. The size of the program in 2010 was approximately $4.5 billion disbursed across an estimated 1,800 eligible telecommunications carriers.
- **Low Income Program**: This support, commonly known as Lifeline and Link Up, provides discounts that make basic, local telephone service affordable for more than 7 million low-income consumers. In 2010, approximately $1.2 billion was disbursed through this program.
- **Rural Health Care Program**: This support provides reduced rates to rural healthcare providers for telecommunications and Internet services so they pay no more than their urban counterparts for the same or similar telecommunications services. In 2010, approximately $240 million was disbursed through this program.
- **Schools & Libraries or E-Rate Program**: This support, commonly referred to as E-rate support, provides affordable telecommunications and Internet access services to connect schools and libraries to the Internet. This support goes to service providers that provide discounts on eligible services to eligible schools, school districts, libraries, and consortia of these entities. In 2010, approximately $2.7 billion was disbursed to schools and libraries through this program (Table IV.3).

Table IV.3 - Universal Service Disbursements - 2010[10]			
USF Program	**Total USF Subsidies (Billion)**	**Puerto Rico USF Subsidies (Million)**	**Puerto Rico Subsidies as Percentage of USF Disbursements**
High Cost Program	$4.5	$208.6	4.89%
Low Income	$1.2	$39.9	3.03%
Rural Health Care	$0.24	$0.0	0.00%
E-Rate	$2.7	$23.2	1.02%
Total USF Disbursement	$7.95	$271.8	3.42%

Source: USAC, Annual Report 2010.

Table IV.4 summarizes the amounts disbursed under the High-Cost program across Puerto Rico fixed and mobile carriers.

Table IV.4 - High-Cost Program Funds in Puerto Rico by Company - 2010[11]		
Company Name	Study Area Name	2010 Support
AT&T Inc.	Centennial Puerto Rico Operations Corp.	$27,058,494
AT&T Inc.	Cingular Wireless	$37,380,228
América Movil	P R T C - Central	$6,996,693
América Movil	Puerto Rico Tel Co	$38,918,358
América Movil	Puerto Rico Telephone Company D/B/A Verizon Wireless Puerto	$46,091,439
Deutsche Telekom AG	Suncom Wireless Puerto Rico Operating Co.	$26,658,105
PR Wireless LLC	PR Wireless Inc.	$17,010,954
Spring Nextel Corporation	Spring Spectrum, LP	$7,935,228
Worldnet Telecommunications	Worldnet Telecommunications	$576,753
TOTAL		$208,626,252

Source: Federal Communications Commission Response to United States House of Representatives Committee on Energy and Commerce Universal Service Fund Data Request of June 22, 2011, Request 3, State-by-State List of Universal Service Fund High-Cost Support Payments.

The New Connect America Fund

The FCC is currently undertaking a step-by-step reform of all the USF's components, starting with the High-Cost program. The core objective of the ongoing reform is to transition the $4.5 billion fund from a support system for voice-telephony networks – a twentieth century technology – to a system that would subsidize broadband access across the U.S. through the creation of the Connect America Fund. This reform is more than a decade in the making and represents a significant development across the broadband industry. The details of the transition of the $4.5 billion annual fund towards both fixed and mobile broadband network construction will have a profound impact upon the quality and nature of broadband services available to millions across the U.S. There will be winners and losers as a result of this reform, with some providers and states experiencing a decrease in total USF disbursements relative to historical levels, with others experiencing a net growth in funding from the Connect America Fund. In the case of Puerto Rico, as discussed below, it is unclear at this point what the final impact will be.

The FCC's USF reform order is complex and involves extensive discussion of a number of important issues, including the use of the State Broadband Initiative broadband availability data to direct funding to "unserved" areas. The transition to the Connect America Fund will take place in two phases starting in 2012 and should be completed by 2017. Through this process funds disbursed under the rules of the historical High-Cost program will be phased out from 2012 through 2015. The purpose of this staged approach is to avoid sudden disruption of businesses and existing services. In particular, the FCC's USF reform plan will:

- Cap the high-cost support program at $4.5 billion per year;
- From 2012-2017, progressively shift that $4.5 billion from existing voice-service subsidies to a program that will support the provision of multi-use broadband and voice networks offering at least **4 Mbps download/1 Mbps upload (actual) fixed broadband** service in "unserved" areas;
- Create a **Mobility Fund** to subsidize mobile broadband that will support the expansion of 3G/4G mobile service in areas currently without such access;
- **Immediately implement a one-time injection of $600 million as early as July 2012** to subsidize fixed and mobile broadband service in areas that have no access available.

The reform underway calls for disparate transition rules and timelines for different categories of service provider, depending on whether they are mobile or fixed carriers, the size of the firm and its regulatory classification. Across Puerto Rico this implies that the impact of these reforms will be different for mobile and fixed providers, for Incumbent Telecommunications Carrier (ILEC) (the Puerto Rico Telephone Company), the three cable operators on the island, and new entrants into the market in the last decade.

To supplement the Connect America Fund, dedicated funding for tribal and remote areas is included in the order. This funding is designed to overcome the distinct, legacy challenges to telecommunications development in those areas and represents an effort by the FCC to ensure that the Order's reforms do not impact tribal or remote areas any more adversely than absolutely necessary.

As a result of this transition, millions of dollars in Connect America Funds will be directed based upon how states, communities, carriers, and policymakers use and understand the State Broadband Initiative (the federal broadband mapping initiative) data in Puerto Rico collected by Connect Puerto Rico in collaboration with broadband providers across the island. The FCC will use current State Broadband Initiative mapping information to create a list of census blocks unserved by fixed broadband infrastructure. These census blocks will be eligible for disbursement of a component of the Connect America Fund - Phase I funds, which amount to $300 million. In parallel, the FCC has already defined eligible areas across the U.S. for the Mobility Fund – Phase I program, which will disburse a maximum of $300 million to subsidize mobile infrastructure build-out across unserved areas. In February of 2012, the FCC released a database identifying eligible areas across the U.S. for the Mobility Fund – Phase I program and established a "challenge" process to this database open to any stakeholder who believes the FCC database is inaccurate. To help assess the accuracy of the eligible areas database, Connect Puerto Rico has conducted an analysis of these eligible areas in Puerto Rico which is available at http://www.connectpr.org/es/node/1492. This analysis reveals that there are very few geographic areas across Puerto Rico that are eligible for funding under the rules set for the Mobility Fund – Phase I.

Impact Across Puerto Rico - Strategic Recommendations

Possibly nowhere more than in Puerto Rico will this reform have a greater potential impact. Like in any reform of this magnitude there will be winners and losers. Individual providers and states or territories may experience a net decrease or increase in revenues disbursed under the Connect America Fund. The impact across individual providers and states or territories will depend on a myriad of program implementation details that the FCC has yet to determine. It is too soon to predict the full impact of this vast reform across Puerto Rico. This will ultimately depend on details determined by the FCC via rule making regarding the process to determine subsidy distributions.

The ultimate goal of this FCC reform is to prioritize funds to areas without broadband service, and where market forces are unlikely to drive investment for lack of a viable business case. As is detailed in Chapter III, Puerto Rico broadband access is significantly lagging behind most jurisdictions across the U.S. Across most U.S. states, upwards of 95% of households have broadband available. By contrast, as of June of 2011, approximately 86% of households across Puerto Rico have broadband available.[12] Due to this significant lag in broadband availability across the island it is expected that – if the FCC succeeds in its stated goals – overall Puerto Rico will be a net winner from this reform. In other words, given Puerto Rico's documented lag in broadband infrastructure and capacity, logic dictates that the amount of funds disbursed across Puerto Rico under the new Connect America Fund should be greater than under the historical High-Cost fund. However, much depends on the details of how this transition will be implemented, which the FCC is working to develop throughout 2012 and the ensuing years. It is imperative that Puerto Rico public and private stakeholders monitor and contribute to the public debate underway at the FCC as these important programmatic details are determined.

In particular, the FCC is in the process of developing complex cost models to estimate the cost of infrastructure build-out where broadband is unavailable, assess expected revenues in those areas from any commercial operation, and estimate the size of the gap to achieve sustainability of these business operations. Based on these generic costs models - the theory goes - the FCC will determine the necessary subsidies needed to attract investment in those areas. Simply put, these cost models strive to determine how much subsidy would be necessary to make a commercial operation whole and, thus, attract private investment now willing to enter those unserved markets. Such cost models are currently being developed at the FCC and will be applied to any area across the U.S. that remains unserved.

On April 25 2012, the FCC released estimates of maximum eligible subsidies for large price cap telecommunications carriers under the planned Connect America Fund – Phase I.[13] Under this Connect America Fund – Phase I up to $300 million will be disbursed across price cap carriers providing a one-time capital injection to subsidize network build-out in unserved areas served by these carriers. In Puerto Rico the only eligible carrier for this Connect America Fund – Phase I is the incumbent carrier Puerto Rico Telephone Company (PRTC). FCC estimates for eligible subsidies by company are based on a cost allocation model designed to simulate the economics of network investment in unserved areas along the contiguous U.S. states. PRTC did not qualify to receive any subsidies under Phase I of the Connect America Fund. One possible explanation for this result is that the logic the FCC used to allocate that $300 million in funding was based on national estimates of the cost of building broadband networks. These estimates did not take into account the unique conditions in Puerto Rico that limit network investment. In particular, the low adoption rate across the island and the costs of broadband backhaul simply were not accounted

Three key factors behind investment lag: lagging demand, high capital investment costs, and high operations costs.

for by the FCC's model, which focused nearly exclusively upon population and business density.

For Puerto Rico, it is imperative that such models take into account critical factors defining the Puerto Rico broadband landscape; in particular, and as described in Chapter III, a drastic lag in broadband demand, resulting in significantly lower expected revenues from any commercial operation. In order to develop a fair assessment of subsidies needed to sustain business operations across unserved areas in Puerto Rico, it is important that the FCC's models do not assume economic factors prevalent across other U.S. jurisdictions, and instead reflect the economic reality of Puerto Rico. Such details will be crucial to achieve fairness for Puerto Rico citizens and businesses that remain unserved, and help overcome the access challenge still facing Puerto Rico. The Puerto Rico Broadband Taskforce will work collaboratively with the FCC to achieve this goal.

Much depends on the reliability of the broadband inventory data that will be used to determine eligible areas for subsidies under the new Connect America Fund. The FCC has determined that a key input into those decisions will be the National Broadband Map database, which in Puerto Rico is managed under the State Broadband Initiative grant program by the Office of the Chief Information Officer and collected by Connect Puerto Rico. It is imperative that these mapping efforts continue and that all broadband providers voluntarily collaborate with Connect Puerto Rico to ensure that the data source used by the FCC to determine the Connect America Fund transition is comprehensive and accurate.

Taking these important considerations into account, the Puerto Rico Broadband Taskforce recommends the following strategies to ensure Puerto Rico citizens fully leverage the opportunities under the new Connect America Fund.

Recommendation:
Puerto Rico's public and private broadband stakeholders should work collaboratively with the FCC to ensure fair and effective allocation of subsidies to unserved areas in Puerto Rico. In particular, models determining the size of subsidies needed to achieve sustainable broadband business plans across Puerto Rico should be based on the economic realities of Puerto Rico, including levels of broadband demand half those expected elsewhere across the U.S.

Recommendation:
All broadband providers should collaborate with Connect Puerto Rico to ensure that broadband inventory data collected under the SBI grant program and used by the FCC to determine the Connect America Fund transition is comprehensive and accurate.

Recommendation:
Public and private broadband stakeholders in Puerto Rico should work collaboratively to reform the Puerto Rico Universal Service Fund (PRUSF) to support the deployment of broadband in unserved areas and ensure that the PRUSF complements the new FCC Connect America Fund program.

While ensuring that the Puerto Rico broadband sector fully leverages the new opportunities under the FCC's Connect America Fund is important and will be instrumental in helping close the access gap across Puerto Rico, it is not the panacea to Puerto Rico's broadband challenge. Ensuring the sustainability and growth of this sector demands coordinated island-wide strategies involving the private and public sectors, including broadband providers and multiple other stakeholders who depend on the technology for their viability. The rest of this chapter examines key challenges affecting the access gap and proposes a series of strategies to ensure sustainability of this critical twenty-first century technology.

With expected demand and revenue flows less than half the U.S. average, the business case for deployment is weakened.

2. Promote Universal Adoption of Broadband Services

Greater adoption of broadband services across the whole population is a key and primary goal to make the broadband sector in Puerto Rico vibrant and sustainable. In a free market, such as the broadband market in Puerto Rico, demand is the key driver of capital investments. As more consumers are willing to pay for services, investment will follow. Yet, with home adoption rates in Puerto Rico less than one-half of the U.S. average – 31% home broadband adoption in Puerto Rico in 2010, contrasting with a U.S. national estimate of 68% home broadband adoption — this lagging demand is a hindrance to continued capital investment.[14]

The challenges of the digital gap that exists today in Puerto Rico are documented in Chapter V of this Strategic Plan, focusing on the adoption gap. **This adoption challenge cannot be met solely by the broadband provider community. Private and public partnerships must work together to address this challenge**. Barriers to adoption primarily include relevance of the service and technology for many disconnected Puerto Ricans, and affordability of both devices to connect to the Internet and the broadband services.

While universal adoption is a key driver of investment, strategies to address the adoption gap are explored in a separate chapter and will not be further discussed here. However, it is essential that efforts to stimulate broadband adoption be understood as essential to achieve investment sustainability in the sector. The following chapter examines in detail factors affecting digital inclusion across Puerto Rico and proposes strategies to overcome the digital divide across vulnerable demographics. Chapters V, VI, and VII of this Strategic Plan examine the broadband adoption and usage challenge across Puerto Rico in depth.

Recommendation:
To encourage sustainable investment in network build-out, Puerto Rico must aggressively implement strategies to promote broadband adoption across vulnerable populations, whether residing in rural or urban areas.

3. Streamline the Regulatory Process
to Promote Fair Competition and Market Entry

Competition in the market is a key trigger for continued investment in broadband upgrades, and improved quality of service and pricing across broadband providers striving to obtain and retain broadband subscribers. As such, it is imperative that the regulatory process effectively monitors anti-competitive behavior in the market, and aggressively strives to remove any entry barriers into the market that may delay or eliminate competition. Where competition is found to be lacking, or anti-competitive behavior is deemed to take place, appropriate action by the Junta or through legislation should be implemented.

Government should facilitate the provision of broadband at higher speeds in rural and urban areas enhancing competitiveness and provision of broadband in unserved and underserved communities. In order to foster economic development, social betterment, promote sustainable competition, and encourage private investment in broadband networks, it is important that the executive branch and the legislative branch understand ways in which government assets, processes, corporations, and other entities can block or promote these goals. In particular, it is important that government assets support the expansion of the broadband market in a competitively neutral way that will promote, and not distort, the competitive process. Government owned assets should facilitate a fair, competitively neutral environment for the telecommunications and broadband market, void of unfair competition from any private or public entity.

Government assets that have a profound impact in the broadband market and can either effectively contribute to broadband expansion, or block its development include Ultracom's underwater cable facilities that provide essential backhaul for data transport; PREPA's network of civil infrastructure including pole attachments that are essential for continued expansion of broadband infrastructure and competition; PREPA.Net's retail and wholesale broadband offers to providers, institutions and end-users; Puerto Rico's roads and transportation infrastructure, providing essential paths for broadband expansion; etc.

In order to promote a vibrant competitive broadband market that attracts the influx of capital necessary to continue expanding our broadband infrastructure, careful assessment of how these assets are contributing or deterring to broadband expansion is necessary.

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Recommendation:
Streamline regulatory process to promote network investment and increase competition in the broadband sector.

Recommendation:
The legislative and executive branches, as well as the Junta Regulamentadora de las Telecomunicaciones, should work to ensure that government assets critical to the broadband market are effectively contributing to the expansion of the market in a fair and competitively neutral way. The Government and regulatory agency should be vigilant of anti-competitive activity blocking market expansion and increased capital investment in broadband capacity across Puerto Rico.

</div>

4. Lower Cost Barriers to Improve the Business Case for Broadband Deployment

Puerto Rico is an island territory, which results in inherently higher costs of deployment and operations of broadband services than across most other jurisdictions in the U.S. The need to connect the island to the Internet backbone via undersea fiber optic cables increases the cost of service. In addition, Puerto Rico's high construction costs, and mountainous tropical topography with high elevations, steep hills, valleys, and thick vegetation result in very high costs for the deployment of last mile infrastructure. These supply-side challenges are aggravated by a lagging demand across the island, which negatively impacts the business case for deployment and broadband growth. Puerto Rico's current economic situation, and the unwillingness and inability of its citizens to pay for the cost of service are at the heart of the digital divide in Puerto Rico. These combined realities are the heart of the deployment lag, documented for the first time through the Connect Puerto Rico mapping data, that persists across many areas of Puerto Rico.[15]

Moreover, the cost of doing business in Puerto Rico is a major deterrent to attracting network operators to the island. Primary concerns include:
- Puerto Rico's labor laws are the most regulated in the nation, and present a serious challenge toward job creation and economic growth.
- Puerto Rico's electricity costs are surging to the point that the Governor has declared an Energy Emergency. The electricity which is provided by the Puerto Rico Electric Power Authority (PREPA) is unreliable and unstable, and results in significant additional costs to broadband providers who must install and maintain costly and insufficient alternative power generation and backup systems (generators/batteries) to ensure ongoing operation of their services in spite of regular power interruptions.

- Puerto Rico's labor pool is shrinking, as a result of increased migration from the island to the mainland. This "brain drain" has resulted in the loss of knowledgeable telecommunications and Internet networking staff.

There are, however, meaningful ways to promote investment by eliminating regulatory, institutional, and other hurdles that impact negatively the business case for deployment. Significant steps can and must be taken across Puerto Rico to improve the business case for broadband deployment and encourage private investment across low-income communities and nonurban areas of the island. This section discusses the challenges to broadband infrastructure investment in Puerto Rico and recommends strategies to address them.

Planning and Coordination

Access to right-of-way inventory at a state and municipal level is essential for effective and expedited outside plant fiber optic network design, deployment and operation, and will spur investment in telecommunication networks. In Puerto Rico, this doesn't exist. This lack of infrastructure planning, coordination, and rights of way and conduit inventory at the state and municipal levels negatively impacts the business case for broadband deployment by resulting in:
- Increased costs for network planning and design, due to ill-defined rights of ways and lack of transparent information regarding local conduits and poles;
- Delays in the permitting processes (which is expanded on below);
- Lack of coordination of infrastructure deployment in urban, densely-populated areas of the island, resulting in spaghetti-like overhead cable infrastructure;
- Lack of identification & coordination of rights of ways, resulting in damages to existing network infrastructure.

The Government of Puerto Rico is already working to improve this process by working with local government officials to improve the planning processes for construction projects. Such efforts should be redoubled as they will impact positively the business case for broadband deployment, as well as other civil engineering and construction projects.

Recommendation:
Promote island-wide and municipal planning
and coordination of construction projects.

High capital investment costs, including permit processing, pole attachment costs, and lack of effective planning and coordination with public authorities, negatively impacts the case for deployment.
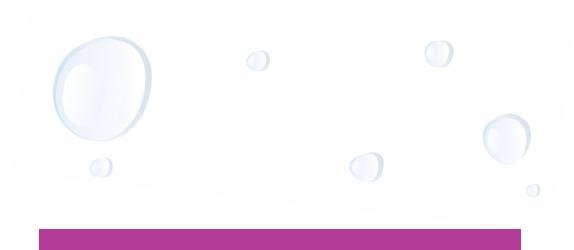
Construction Permitting Processes

According to the World Bank's "Doing Business 2012" comparative data regarding the ease of acquisition of construction permits, Puerto Rico is ranked 152 of 183 economies assessed on the ease of dealing with construction permits (up from 166th in 2011).[16] This significant improvement is the result of a concerted effort by the Government of Puerto Rico, working in partnership with the private sector, to streamline the construction permitting process at all levels of government. Despite these significant improvements, permitting and Rights of Way (RoW) processing remains a significant burden for construction of any kind across Puerto Rico. According to the World Bank, dealing with construction permits in Puerto Rico entails an average of 189 days, at a cost of 369.1% of average income per capita. By contrast, across OECD countries, construction permits entail an average of 152 days at a cost of 45.7% of the average income per capita. Across Latin America and the Caribbean construction permits entail an average of 221 days at a cost of 160.3% of the average income per capita.[17]

These permitting delays and the relative high costs of permitting processing directly impact the business case for broadband deployment in Puerto Rico by resulting in higher construction costs, greater cost of capital, and delayed revenue sources. The current administration has recognized this challenge and changes have been implemented to streamline the processes. However, for Puerto Rico to compete in the global economy, additional measures must be implemented to speed permitting and RoW approval and lower its costs.

This goal affects not only the broadband sector, but also all aspects of the Puerto Rico society. As a result, we recommend the formation of a public-private taskforce charged with reviewing this challenge and proposing specific tactics to improve this process. The taskforce would be ideally comprised of representatives from multiple industries including the broadband sector and other network industries, transportation and other construction and general manufacturing, as well as representatives from both local and island-wide government directly involved in permitting processes. The taskforce will address, among other, the following objectives:
1. Overall assessment of the layers of bureaucracy entailed in the permitting process with the goal to eliminate redundancies and streamline the process;
2. Encourage consolidation of processes island-wide so that permitting can be accelerated;
3. Institute a fast-track permitting route across all municipalities so permit applicants faced with a rejection can resubmit applications without having to necessarily start the process over;
4. Establish maximum timeline goals for permitting, pole attachment, and RoW approval that can be measured and tracked across various local and island-wide government jurisdictions. For example, in order to encourage and support efforts to build out networks, permitting processes should be accelerated, with a target of response within 30 days.

> **Recommendation**:
> Continue streamlining the construction permit process and Right of Way (RoW) approvals process in order to ensure lower costs of infrastructure build-out and processing timeframes.

Dig-Once Policies

Dig-Once policies would require any new roads, mass-transit projects, sidewalks, housing developments, and other construction projects partially or fully funded by the government of Puerto Rico, to include plans to incorporate conduits that can house fiber-optic cable that will sustain future data services (high-speed broadband/IPTV/Voice Over IP, etc.). The legislation must be competitively neutral and ensure that all broadband providers, regardless of technology used or regulatory status, have equal access to these conduits. Similar proposals have been made by the FCC's National Broadband Plan[18] as well as by members of the U.S. Congress including Rep. Anna Eshoo (California) who introduced similar federal legislation, and stated: "The legislation is a creative approach to more rapidly deploy broadband service, promote competition and do so with limited dollars. The 'dig once' policy would expand broadband at a fraction of the cost by including the conduit as roads are being built."[19] Puerto Rico Law 101 of 2005 is a step in the right direction regarding the needs to coordinate underground infrastructure deployment. Resolution of the Senate 1639 (R. de la C. 1639), approved in the Senate in December 2011 to study the viability and convenience of including subterrain conduit systems in all public contracts for highway and road construction, is also an important step in the right direction.[20]

> **Recommendation**:
> Institute legislation that will encourage "Dig Once" policy for all future transportation and civil engineering construction projects.

Colocation in Public Buildings

Across regions of Puerto Rico that remain unserved, there is a need for access to colocation space in public buildings. Such colocation space would enable competing broadband providers to securely house the network access equipment necessary to provide service to public institutions, including government offices, public schools and hospitals, public housing buildings, public safety locations, etc.

Because government remains a key source of demand in the overall Puerto Rico broadband market, the expansion of such colocation space across public buildings will help spur competition. The proposed legislation would ensure that all colocation facilities in public buildings would be made available to all providers on equal terms and conditions, regardless of historic distinctions between telecommunication providers.

> **Recommendation**:
> Institute legislation that ensures competitively neutral access to colocation infrastructure in public buildings.

State & Municipal Tax Policies Pro-Investment

As a result of Puerto Rico's current economic downturn, public sector leaders are seeking new revenue sources to address budget shortfalls. This search for new local government revenue sources has led various municipal governments to contemplate the idea of imposing future fees or taxes on broadband infrastructure in their municipalities. These proposals present uncertainty in the broadband market and, as in any market, uncertainty of future costs means weaker business cases for deployment. All of which ultimately results in lagged network deployment and higher costs to the Puerto Rico consumer.

As importantly, these short-sighted proposals fail to understand that, if implemented, such strategies would slow growth of the very infrastructure that is necessary to reverse the island's economic contraction and to stimulate economic development and ultimately recuperate recent municipal tax losses. Municipalities with broadband infrastructure will (a) attract and retain residents and businesses; (b) create new job opportunities; (c) improve educational opportunities for students; (d) provide more effective means to deliver local healthcare services; (e) improve efficiencies of local public safety enforcement; and many others. In short, taxing local broadband deployment means taxing the economic engine necessary for that local community to ensure economic growth and competitiveness.

To encourage the expansion of high-speed broadband networks and ameliorate cost uncertainties, the Puerto Rico government should work with municipal government officials to ensure that new infrastructure installed for broadband services on public or private property, roads, easements or rights-of-way will not be subject to further state or municipal tax or fees.

Recommendation:
Reduce uncertainty of future costs by encouraging implementation of tax and fee policies by state and municipal government aimed to attract investment and encourage broadband network build-out.

Pole Attachment Costs

Broadband providers rely on pole attachments to deploy their infrastructure across the Puerto Rico landscape. Pole attachment costs are an important component of the capital investment and operations necessary to deliver broadband services. Recognizing the role of pole attachment in the development of the broadband market, the FCC recommended in its National Broadband Plan for the establishment of rental rates for pole attachment as low and close to uniform as possible.[21] According to the FCC's National Broadband Plan, the national average pole attachment rate ranges between $7-$10 per foot per year.[22]

In Puerto Rico, PREPA.Net, a competitive broadband service provider and a subsidiary of the Puerto Rico Electric and Power Authority (PREPA), a wholly-owned government entity and the island's electric power supplier, is the primary provider of poles used by broadband providers. Contractual documentation regarding PREPANET's pole attachment rates reveals higher rates across Puerto Rico, despite the fact that Puerto Rico's average household income significantly lags even some of the poorest U.S. states. Pole attachment rates charged by PREPA are $12.10 per attachment of a cable or other device. If the equipment requires more than one attachment, each would be charged separately. The minimum number of pole attachments per contract is 1,000. Finally, contractually PREPA can take up to 35 days to approve or reject petitions for new pole attachments.[23]

High and volatile energy costs, high cost of backhaul traffic and high rates of theft and fraud drive costs and, ultimately, result in higher prices for consumers.

These high pole attachment rates are ultimately passed on to consumers, unnecessarily increasing the retail prices and potentially pricing out of the market low income households across Puerto Rico. As such, high pole attachment costs are a key barrier to overcome the digital divide in Puerto Rico. To overcome this challenge, we recommend the formation of a taskforce to evaluate pole attachment costs and processes across the island and work to reduce its costs and improve efficiency of attachment processes. Such a taskforce should include key stakeholders in this process, including government officials, PREPA, JRT, broadband providers, and other stakeholders. The recent rulemaking by the FCC on pole attachment fees should be considered by the taskforce in the evaluation process.

Recommendation:
Establish low and uniform pole attachment rental rates
and efficient processes.

Recommendation:
To achieve this goal, establish the formation of a taskforce to evaluate pole attachment costs across the island and work to improve efficiency of pole attachment processes.

IP Traffic Peering

One of the drivers of high cost for broadband providers in Puerto Rico is the means of terminating local IP traffic between networks and the high cost of backhaul. There are clear cost, quality of service, and security benefits to maintaining the flow of local communications through the island's local broadband networks and within the island's shorelines.

The Government of Puerto Rico should encourage efforts for the local interconnection and peering of broadband networks, and support compliance with the FCC rules for network openness, non-discrimination & interconnection by establishing minimum service level requirements from broadband providers.

Recommendation:
Promote local network interconnection and peering to lower costs
of backhaul traffic in Puerto Rico.

Recommendation:
Create minimum service level requirements for broadband providers serving local government agencies and entities.

Economic Incentives to Promote Broadband Investment

While the Economic Incentives for the Development of Puerto Rico Act (Act No. 73 of May 28, 2008) was created to "provide an adequate environment and opportunities for the continued development of our local industry" and provide tax benefits that "fosters the economic development and social betterment in Puerto Rico," it does not specifically provide benefits to broadband service providers, whose services are essential in order to facilitate the export of services and goods outside of Puerto Rico.[24] Expanding these economic incentives to apply to the operation of operation and deployment of broadband services will promote broadband infrastructure investment and have a significant impact across the broadband landscape in Puerto Rico. Significant local and foreign investment could be attracted if the benefits under the Act were also extended to revenues and costs associated with broadband services (as defined by the FCC).
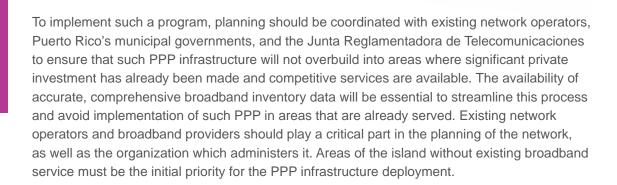
> **Recommendation**:
> Institute legislation to amend Act No. 73 of May 28, 2008,
> to include companies which operate and deploy
> broadband networks in Puerto Rico.

Promote Public-Private Partnerships to Expand Infrastructure Across Unserved Areas

There are areas of Puerto Rico where it is not economically viable for the private sector to invest in the deployment of next-generation broadband services. Given that universal access and adoption of broadband is critical for Puerto Rico's economic growth and well-being, additional efforts must be made to facilitate the provision of competitive broadband services in these areas by private network operators.

In order to serve the residents of these regions, the Government of Puerto Rico should consider the development of public-private partnerships (PPP) to provide infrastructure for use by all telecommunication and broadband providers. This PPP network would be composed only of dark, passive network infrastructure (i.e. dark fiber) that would provide layer-1 service elements to third parties on a wholesale basis exclusively, thus eliminating any potential anti-competition distortions generated between PPP operators serving an area and competitive broadband or telecommunication providers using the network. All end users and customers of this PPP network would be able to receive similar, competing services from multiple providers over this common infrastructure. All service providers must be given access to the infrastructure at a regulated, tariffed rate to ensure appropriate end-user pricing.

To implement such a program, planning should be coordinated with existing network operators, Puerto Rico's municipal governments, and the Junta Reglamentadora de Telecomunicaciones to ensure that such PPP infrastructure will not overbuild into areas where significant private investment has already been made and competitive services are available. The availability of accurate, comprehensive broadband inventory data will be essential to streamline this process and avoid implementation of such PPP in areas that are already served. Existing network operators and broadband providers should play a critical part in the planning of the network, as well as the organization which administers it. Areas of the island without existing broadband service must be the initial priority for the PPP infrastructure deployment.

> **Recommendation**:
> Institute legislation for the establishment of public-private partnerships (PPP) for the exclusive purpose of designing, building, and operating a fully-passive fiber optic network to the premise in currently unserved areas for wholesale use by any *bona fide* telecommunications or broadband provider.

Energy Costs

To address these structural problems, the Government of Puerto Rico should continue to develop measures to help stabilize the price and reliability of energy on the island, and shelter Puerto Rico from sharp price fluctuations in the international energy market. Predictability of energy costs will significantly improve the business cases for broadband deployment as well as across any other sector with high energy use.

> **Recommendation**:
> Continue implementing policies aimed to stabilize the price of energy across the island.

Theft Law Enforcement

Crime in Puerto Rico is at an all-time high, and has its impact on the telecommunications industry as well. Over the past decade, there has been a significant increase in the theft of service as well as infrastructure, including copper cables, telecommunication tower parts, generators, batteries, among other items. Ultimately, service and infrastructure theft leads to higher prices and poor service to consumers.

The Puerto Rico Telecommunications Regulatory Board (JRT) has taken strong, swift action in the past year to address the rising problem of copper theft. JRT also is pursuing cases of theft of service. These efforts should be complemented to prevent future crime by working proactively to more effectively enforce existing laws and prosecute individuals who cause physical harm and damage to Puerto Rico's communications infrastructure.

> **Recommendation**:
> Improve law enforcement efforts to reduce the theft of broadband network infrastructure and reduce service theft.
>
> **Recommendation**:
> Incentivize deployment of fiber networks, thereby reducing reliance on copper networks targeted by thieves.

Excavation Law Enforcement

Another problem affecting the security and robustness of broadband infrastructure, and ultimately increasing the cost of providing the service across the island, is the poor enforcement of excavation laws designed to ensure protection for all existing infrastructure. The Public Service Commission's Center for the Coordination of Excavations and Demolitions (Centro de Coordinación Excavaciones y Demoliciones) is the state entity responsible for coordinating all excavation and, or demolition work. Its goal is to ensure ease of construction projects while ensuring the protection of subterranean infrastructure and assets, such as tubes, ducts, gas lines, and telecommunication facilities. Due to poor enforcement of excavation laws, including inconsistent issuance of fines to violating public and private entities, broadband infrastructure across the island is being seriously affected. This results in increased costs to network operators, serves as a deterrent to broadband network build out, and impacts the reliability and quality of Puerto Rico's broadband systems. All of which ultimately harms Puerto Rican consumers who will experience unnecessary service outages and greater cost of the broadband service. To ensure ongoing communication services and to protect consumers against unnecessary service interruptions, swift action must be taken to ensure compliance by all entities that carry out excavation work.
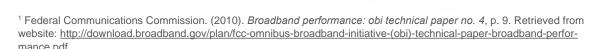
> **Recommendation**:
> Improve the enforcement of existing excavation laws to reduce damages to infrastructure assets and end-user service interruptions.

Endnotes

[1] Federal Communications Commission. (2010). *Broadband performance: obi technical paper no. 4*, p. 9. Retrieved from website: http://download.broadband.gov/plan/fcc-omnibus-broadband-initiative-(obi)-technical-paper-broadband-performance.pdf

[2] Federal Communications Commission. (2010). *Broadband performance: obi technical paper no. 4*, p. 16. Retrieved from website: http://download.broadband.gov/plan/fcc-omnibus-broadband-initiative-(obi)-technical-paper-broadband-performance.pdf

[3] Federal Communications Commission, (2011). *Connect America fund report & order*. Retrieved from website: http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db0206/FCC-11-161A1.pdf

[4] Federal Communications Commission. (2010). *National Broadband Plan*, p. 9. Retrieved from website: http://www.broadband.gov/plan/3-current-state-of-the-ecosystem/

[5] Ibid.

[6] Dutta, S., & Bilbao-Osorio, B. World Economic Forum, (2012). *The global information technology report*. Retrieved from website: http://www3.weforum.org/docs/Global_IT_Report_2012.pdf

[7] Availability data by speed tier collected Connect Puerto Rico follows the speed tiers prescribed by the National Telecommunications Information Administration broadband mapping rules (see the previous chapter for further details). As such, the National Broadband Map and data in Puerto Rico does not measure availability at actual speeds of 4 Mbps (DL)/1 Mbps (UL). To proxy the digital gap, the FCC has proposed to use a combination of the most relevant speed tiers measured via the National Broadband Map (3 Mbps/768 Kbps and 6 Mbps/1.5 Kbps).

[8] Federal Communications Commission, (2011). *Connect America fund report & order*. Retrieved from website: http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db0206/FCC-11-161A1.pdf

[9] For more information on the USF program and its components refer to Universal Service Administrative Company (USAC) at www.usac.org

[10] Universal Service Administrative Company, (2010). *Usac 2010 annual report*. Retrieved from website: http://www.usac.org/_res/documents/about/pdf/annual-reports/usac-annual-report-2010.pdf

[11] Federal Communications Commission. (2011). *Federal communications commission response to united states house of representatives committee on energy and commerce universal service fund data request of june 22, 2011*. Retrieved from website: http://republicans.energycommerce.house.gov/Media/file/PDFs/2011usf/ResponsetoQuestion3.pdf

[12] For a detailed assessment of the broadband inventory across Puerto Rico see Chapter III of this Strategic Plan.

[13] Federal Communications Commission, (2012). *Wireline competition bureau announces support amounts for Connect America Fund-Phase One incremental support*. Retrieved from website: http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db0425/DA-12-639A1.pdf

[14] Ibid.

[15] Ibid.

[16] World Bank Group, International Finance Corporation. (2012). *Ease of doing business in Puerto Rico*. Retrieved from website: http://www.doingbusiness.org/data/exploreeconomies/puerto-rico/

[17] Ibid.

[18] Federal Communications Commission. (2010). *National Broadband Plan*. Retrieved from website: http://www.broadband.gov/plan/6-infrastructure/

[19] California's 14th District. (2011). *Rep. Eshoo urges department of transportation to implement cost-saving measures to expand broadband deployment*. Retrieved from website: http://eshoo.house.gov/index.php?option=com_content&view=article&id=1111:rep-eshoo-urges-department-of-transportation-to-implement-cost-saving-measures-to-expand-broadband-deployment&catid=51:2011-press-releases

[20] Government of Puerto Rico, Senate of Puerto Rico. (2010). Retrieved from website: http://www.oslpr.org/files/docs/{03008237-53C6-4CF3-9D56-145D19A89102}.doc

[21] Federal Communications Commission. (2010). *National Broadband Plan*, p. 128. Retrieved from website: http://www.broadband.gov/plan/6-infrastructure/

[22] Ibid.

[23] Puerto Rico Electric and Power Authority. Retrieved from website: http://www.prepa.com/

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Chapter V:
All Puerto Ricans Online!
Expanding Broadband Adoption

Stimulating broadband adoption across all segments of society is imperative to ensure a vibrant economy and to promote continued investment in broadband capacity.

A. Introduction

Promoting adoption of broadband service across all segments of society and in all areas across Puerto Rico, whether urban or rural, is a key goal of this Strategic Plan for two core reasons. First, in a market economy, demand drives supply – investment in access or infrastructure build-out – and, hence, demand stimulation becomes a core strategy in promoting investment in capital infrastructures and addressing the infrastructure gap described in the previous chapter. Private Puerto Rico entities competing for government, business, and residential customers determine their infrastructure build-out based on the expected revenue stream stemming from those investments. As demand for broadband services grows, the economics of network build-out and capacity expansion are improved, leading to more and better networks. Broadband and information technology are "sticky" – once used, citizens, businesses, and government agencies alike become dependent upon the economic and welfare benefits of online activities and rarely revert back. Hence, demand stimulation is a core strategy for sustainability of this Strategic Plan.

Second, adoption of broadband service – and not access – is the true objective of this Strategic Plan. The goal is not to have universal access per se, but rather to have citizens adopting and using this network and information technology for ever-more empowering and productive activities. The success of the digital age does not rest in more or better broadband "pipes" and should not be measured in terms of access bits, but rather in terms of number of adopters and scope and quality of usage of the technology.

Some might question what should be the role of government to address barriers to broadband adoption across vulnerable populations. While market forces are effectively driving market growth in the sector across a large segment of the society, that growth does not reach all segments and regions. Broadband technology is today a key enabler of economic opportunity, social interaction, and is critical in supporting first responders during a disaster situation. Increasingly, communities and citizens that are left behind this empowering technology have to overcome ever-greater challenges to obtain economic independence and fully participate in the social discourse of our nation. Hence, it is in the interest of both private and public leaders to work together to overcome the barriers to IT and broadband technology among the most vulnerable.

In assessing this position, it is important to understand that there is a big difference between traditional voice telecommunications services and the adoption of IT and broadband technology. In traditional voice telecommunications, demand and adoption of the service has not been a primary concern of policy makers. Voice telecommunications policy frameworks have been primarily focused on supply-side concerns. Where lack of access to voice telephony networks has been a core concern, telecommunications policy has been focused first and foremost on promoting universal access to the service, and, secondarily, to promote and monitor competition where it exists, or regulate the voice service monopoly where competition is not deemed possible. Traditional voice telecommunications policy has not been focused on demand-side issues because, for voice services, the old adage of "build it and they will come" works. Appreciating the value of voice communications and understanding how they work requires only a try. Importantly, the entry cost of acquiring a customer access device – in this case a phone – is limited and rarely constitutes a significant barrier to entry even across low-income segments of the population.

By contrast, the cost of a computer or personal device necessary to use broadband service and access the Internet can be prohibitive to lower-income demographics, and across the region can be an important barrier to the full expansion and leverage of broadband technology. In order to close the digital gap, it is imperative that we address this adoption challenge and examine computer or device cost entry challenges through policies that may include fiscal incentives for the purchase or lease of the equipment, direct subsidies of equipment aimed to certain segments of the population or key professionals (such as educators, healthcare providers, first responders, or others), or the promotion of public computing centers serving vulnerable populations.

Furthermore, failing to understand the value of online resources and how to use a computer, tablet, or mobile device to access the benefits of broadband is a barrier to adoption of broadband technology for many. Historically, adopting voice communications devices was a self-taught discovery process that may have required several minutes. By contrast, data communications devices are much more complex and usually require external training and guidance. Addressing these barriers to broadband expansion through policies to promote digital literacy and campaigns to build awareness of the benefits of online interaction for both personal use and small business enterprises need to be incorporated into the tool kit of effective broadband policy.

By 2013, residential home broadband adoption across Puerto Rico should be at least 50% and by 2015 at least 70%.

The vision and recommendations presented in this Chapter builds upon previous work conducted by Puerto Rico partners, as outlined in Section B of this Chapter, and federal resources including:

- FCC's National Broadband Plan – Adoption Chapter[1]
- FCC's NPRM and Order on the USF Low Income Program reform (Lifeline)[2]
- FCC Chairman's vision for a connected America through the Connect to Compete program[3]
- The U.S. Department of Commerce's report, *Exploring the Digital Nation: Computer and Internet Use at Home*.[4]

With this vision of the importance of universal adoption and the role of public-private partnership to achieve this goal, the Puerto Rico Broadband Taskforce sets the following goals:

Strategic Goals for Puerto Rico - Adoption

All Puerto Ricans, regardless of income, race, gender, age or location, should have access and the willingness to partake and benefit from the online opportunities available through broadband.

Adoption Goals:
- By 2013, residential home broadband adoption across Puerto Rico should be at least 50% and by 2015 at least 70%.
- By 2015, adoption of broadband by all business with more than 4 employees.
- By 2015, 90% of the Puerto Rico population should have access to a broadband enabled computer or other mobile devices, either at home, work or via personal connection.

This chapter builds upon Chapter III, and examines the broadband adoption gap across Puerto Rico in detail, focusing attention on at-risk demographic groups and the barriers to broadband and related technologies adoption. It then presents an inventory of existing programs across Puerto Rico working to overcome barriers to broadband and IT. Building upon this information the final section outlines a series of aspirational goals for broadband adoption across Puerto Rico and strategic recommendations to achieve these goals.

An estimated 69% of all Puerto Rico households do not subscribe to broadband. Of those that have broadband available, 55% choose not to subscribe.

B. The Puerto Rico Technology Adoption Gap

This section analyzes the technology adoption gap across Puerto Rico's residential sector. The analysis is based on the 2010 Connect Puerto Rico Residential Assessment, a consumer survey implemented by Connect Puerto Rico in 2010 aimed at understanding demand-side trends and barriers in the Puerto Rico broadband market. The survey was conducted by Connect Puerto Rico on behalf of the Office of the Chief Information Officer as part of the State Broadband Initiative (SBI) federal grant program, and funded through the American Recovery and Reinvestment Act. Data were collected by Estudios Técnicos in Puerto Rico and weighting and research consultation were provided by Lucidity Research, LLC.

1. Fixed Broadband Adoption

According to the broadband landscape outlined in Chapter III of this Plan, residential survey research conducted by Connect Puerto Rico in 2010 indicates that 31% of Puerto Ricans have a broadband connection in the home.[5] The most recent comprehensive broadband network inventory conducted by Connect Puerto Rico estimates that 86% of all Puerto Rico households have broadband available at the basic speeds of 768 Kbps download/ 200 Kbps upload. This implies an adoption gap in Puerto Rico of 55% of households; in other words, more than one-half of Puerto Ricans have basic broadband service available but, for various reasons, are choosing not to subscribe to the service in their home (Figure V.1).

Figure V.1 - Puerto Rico Broadband Adoption Gap

Broadband not available 14%

Subscribe to broadband 31%

Broadband available, but do not subscribe (Adoption Gap) 55%

Across Puerto Rico, only 31% of households subscribe to broadband, compared to an average of 68% across the U.S.

In 2010, 50% of Puerto Rico adults reported having a home Internet subscription. Of these 1.5 million adults, 31% reported subscribing to home broadband, 10% reported subscribing to dial-up Internet service, and 9% report home Internet subscriptions, but could not recall the connection type (Figure V.2). Another 14% reported only accessing the Internet outside of their home. Combined, 64% of Puerto Rico adults accessed the Internet either at home or outside of the home in 2010, but only 31% report accessing the Internet from a home broadband connection.

In comparison, 71% of U.S. households report subscribing to the Internet in 2010, and more than two-thirds (68%) reported subscribing to broadband.[6] Indeed, a shrinking share of home Internet users – about 3% of households in 2010 – used dial-up to access the Internet, down from 5% in 2009.[7] Another 9% of households had Internet users who only access the Internet outside the home. Together, these figures indicate that 80% of American households in 2010 had a least one resident who accessed the Internet from home or elsewhere.
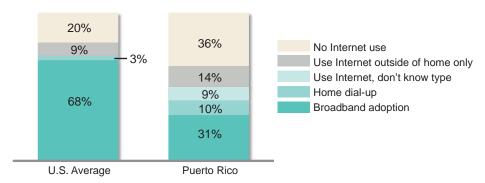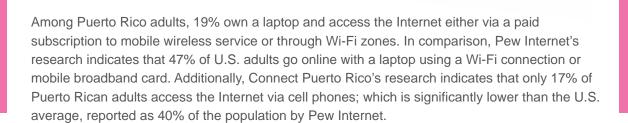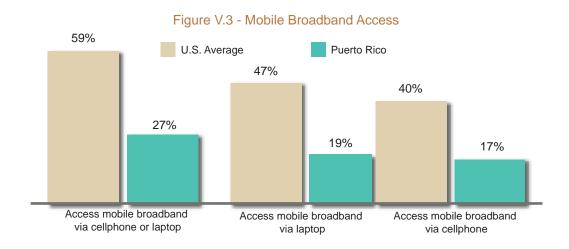
Figure V.2 - Broadband Adoption Gap Comparison

U.S. Average:
- 20% No Internet use
- 9% Use Internet outside of home only
- 3% Use Internet, don't know type
- 68% Broadband adoption

Puerto Rico:
- 36% No Internet use
- 14% Use Internet outside of home only
- 9% Use Internet, don't know type
- 10% Home dial-up
- 31% Broadband adoption

Legend:
- No Internet use
- Use Internet outside of home only
- Use Internet, don't know type
- Home dial-up
- Broadband adoption

2. Mobile Broadband Adoption

Advances in mobile technologies are making Internet access more available and affordable than ever before, highlighting the critical role that mobile broadband deployment plays in bridging the digital divide. According to Connect Puerto Rico's June 2011 broadband inventory, 99.6% of Puerto Rico households have access to mobile broadband from at least one mobile provider.[8] However, while over one-third of Puerto Rico residents (37%) own a laptop computer, and more than three out of five residents (62%) report owning a cellphone, only 27% of Puerto Rico residents report accessing mobile broadband service (Figure V.3).[9] In comparison, according to Pew Internet's Mobile Access 2010 report, 59% of U.S. adults reported accessing mobile broadband.[10]

Among Puerto Rico adults, 19% own a laptop and access the Internet either via a paid subscription to mobile wireless service or through Wi-Fi zones. In comparison, Pew Internet's research indicates that 47% of U.S. adults go online with a laptop using a Wi-Fi connection or mobile broadband card. Additionally, Connect Puerto Rico's research indicates that only 17% of Puerto Rican adults access the Internet via cell phones; which is significantly lower than the U.S. average, reported as 40% of the population by Pew Internet.

Figure V.3 - Mobile Broadband Access

During the first decade of the twenty-first century, U.S. household technology adoption grew dramatically. Figure V.4 provides a measure of the time lag in technology adoption across Puerto Rico relative to the U.S. Despite this technology becoming an ingrained feature of everyday life for most Americans, Puerto Rico's overall home computer and Internet adoption in 2010 is comparable to the September 2001 U.S. average. Furthermore, mobile broadband usage in Puerto Rico is equal to about one-half of the U.S. average. Finally, at 31%, Puerto Rico's broadband adoption is less than one-half of the U.S. average, meaning approximately 2.1 million Puerto Rico residents do not have home broadband access.

Puerto Rico's overall home computer and Internet adoption in 2010 is comparable to the U.S. average in 2001.
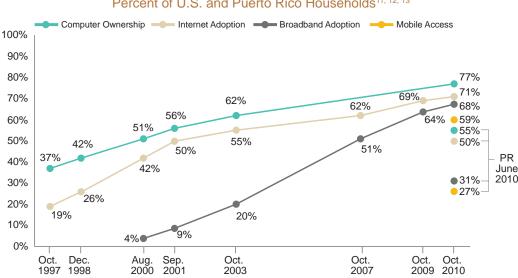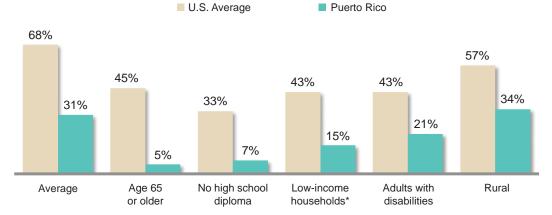
Figure V.4 - Overview of Household Adoption Rates by Technology - Percent of U.S. and Puerto Rico Households[11, 12, 13]

3. Broadband Adopters and Non-Adopters

In the United States, the U.S. Census Bureau, in collaboration with the National Telecommunications and Information Administration, found that broadband non-adopters are generally people of low-income, senior citizens, members of ethnic minorities, rural dwellers, people with disabilities, and/or people with less education. According to the 2010 Connect Puerto Rico Residential Technology Assessment, these trends are in line with non-adoption rates reported by similar demographic groups in Puerto Rico; however, the adoption gap in Puerto Rico for each of these demographic groups is more acute. Figure V.5 contrasts Puerto Rico and U.S. adoption gaps among selected demographic groups.[14] While across Puerto Rico broadband adoption is 31%; senior citizens, low-income residents, adults with disabilities, and adults with lower educational levels disproportionately find themselves on the wrong side of the digital divide. The broadband adoption rate is 5% among adults 65 and older; 7% among residents without a high school diploma; 15% among households with annual incomes below $15,000; 21% among adults with disabilities; and 34% among rural households.

Figure V.5 - Residential Broadband Adoption by Demographic Group
in U.S. and Puerto Rico

■ U.S. Average   ■ Puerto Rico

	Average	Age 65 or older	No high school diploma	Low-income households*	Adults with disabilities	Rural
U.S. Average	68%	45%	33%	43%	43%	57%
Puerto Rico	31%	5%	7%	15%	21%	34%

* U.S. low-income = households reporting annual income less than $25,000.
Puerto Rico low-income = households reporting annual income less than $15,000.

4. Main Drivers of the Adoption Gap

The 2010 Connect Puerto Rico Residential Technology Assessment indicates that the main demographic drivers of broadband adoption are income, education attainment, and age; the first two being highly correlated (Figure V.6).

- **Income**: Income appears to be the biggest dividing line of broadband adoption. More than one-half of Puerto Rico residents reporting an annual median household income of more than $15,000 (52%) report having home broadband subscriptions. Among those reporting an income of less than $15,000, only 15% report having home broadband subscriptions.
- **Education**: Among those who have some college experience, 45% have broadband at home, compared with 18% of those whose highest level of education attainment is a high school diploma.
- **Age**: While older residents tend to have lower broadband adoption rates, in Puerto Rico adoption is very low. Only 5% of residents age 65 or older report subscribing to home broadband.

The main demographic drivers of broadband adoption are income, education attainment, and age.

Figure V.6 - Technology Adoption by Education, Age, and Annual Household Income

Computer ownership ■   Broadband adoption ■

Category	Computer ownership	Broadband adoption
Puerto Rico total	55%	31%
High school grad or less	39%	18%
Some college or more	73%	45%
Age 18-64	63%	37%
Age 65 or older	20%	5%
Less than $15,000	37%	15%
$15,000 or more	78%	52%

a. Affordability

While income appears to be the main driver of the broadband adoption gap in Puerto Rico, Connect Puerto Rico's 2010 Residential Technology Assessment confirms that affordability is indeed a key reason why Puerto Rico's residents do not adopt.

In 2010, Puerto Rico residents surveyed reported paying an average of $42.37 per month for their home broadband service. In comparison, a 2010 Pew Internet study found that the average American broadband subscriber paid $41.18 per month for service.[15] Furthermore, although Puerto Rico households are, on average, paying more for their broadband, despite having a considerably lower average household income, they're receiving significantly slower speeds. Puerto Rico broadband subscribers who know their broadband speed report an average download speed of 3.3 Mbps, compared to the average of 6.0 Mbps reported across various U.S. states similarly surveyed by Connected Nation.[16] When Puerto Rico broadband subscribers were asked about their satisfaction with their home broadband subscriptions, 64% responded that they were very satisfied, followed by 34% who were somewhat satisfied, and 2% who reported being dissatisfied with their current broadband service. Among unsatisfied subscribers, the majority reported that frequent service outages were an issue.

Affordability of the service is a key factor for many non-adopters across Puerto Rico. An estimated 16% of Puerto Rico's non-adopters (approximately 322,000 Puerto Rico residents without a home broadband subscription) report that expense is a barrier to their broadband adoption. In addition, 27%, or approximately 362,000 Puerto Ricans, report that expense is a barrier to home computer ownership, a prerequisite for a home broadband subscription. Unfortunately, vulnerable population segments feel the impact of expense more than others (Figure V.7). Low-income households and households with children – two population segments that could stand to benefit most from broadband – have particularly low adoption levels. Approximately 433,000 children across Puerto Rico cannot enjoy the benefits of broadband in the home, largely due to the inability to purchase a computer or to pay the monthly subscription fee.[17]
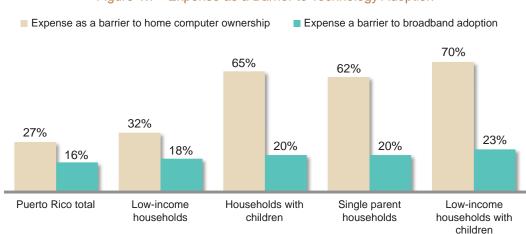
Figure V.7 - Expense as a Barrier to Technology Adoption

■ Expense as a barrier to home computer ownership ■ Expense a barrier to broadband adoption

	Puerto Rico total	Low-income households	Households with children	Single parent households	Low-income households with children
Expense as a barrier to home computer ownership	27%	32%	65%	62%	70%
Expense a barrier to broadband adoption	16%	18%	20%	20%	23%

To put the affordability challenge in perspective, it is estimated that approximately 42% of Puerto Rico households have an annual income of less than $15,000.[18] For these residents, the cost of broadband represents approximately 3.4% of their annual income, which, according to the International Telecommunications Union, is considered unaffordable (Figure V.8).[19] According to this standard, more than two-fifths of Puerto Rico residents do not have access to "affordable broadband."

The cost of broadband for Puerto Rico households with annual income below $15,000 represents approximately 3.4% of their annual income.

Figure V.8 - Annual Broadband Subscription Cost as a Percentage of Income

	Less than $15,000	$15,000 to $24,999	$25,000 to $34,999	$35,000 to $49,999	$50,000 or more
Cost	$516.84	$555.60	$501.72	$449.88	$503.28
Percentage	3.4%	2.8%	1.7%	1.1%	1.0%

b. Relevance and Computer Ownership

While making broadband and related technologies affordable is fundamental to bridging the digital divide, cost alone is not a sufficient factor to explain, nor an adequate lever to address, the gap in home broadband adoption. Communities with a large percentage of non-adopters face multiple overlapping challenges to broadband use, from skill and language barriers, to provider access as well as public access points. For instance, Figure V.9 presents a comparison of broadband adoption among Puerto Rico and the average of jurisdictions surveyed by Connected Nation in 2010. While adoption levels among higher income categories are comparable, broadband adoption among Puerto Rico households making less than $15,000 are nearly one-half of the Connected Nation average.
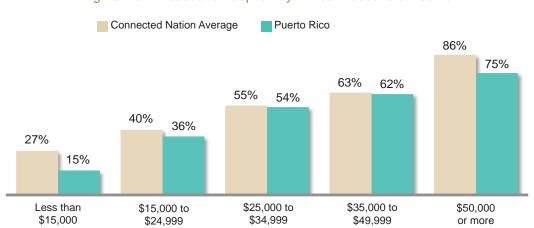
Figure V.9 - Broadband Adoption by Annual Household Income

Connected Nation Average ◼ Puerto Rico ◼

	Less than $15,000	$15,000 to $24,999	$25,000 to $34,999	$35,000 to $49,999	$50,000 or more
Connected Nation Average	27%	40%	55%	63%	86%
Puerto Rico	15%	36%	54%	62%	75%

Lack of relevance of broadband technology is the key barrier to broadband adoption among Puerto Rico non-adopters.

What else is driving non-adoption? Among low-income Puerto Rico households, the lack of a home computer is the main barrier reported. However, overall, the largest barrier to broadband reported among Puerto Rico non-adopters is the lack of relevance that broadband has in their lives, cited by nearly one-third of non-adopters. In other words, their perceived benefits of broadband do not justify the monthly expense. In fact, regardless of household income, relevance as a barrier remains fairly consistent (Figure V.10).
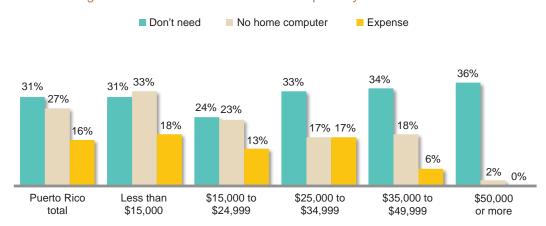
Figure V.10 - Barriers to Broadband Adoption by Household Income

Legend: ■ Don't need ■ No home computer ■ Expense

	Puerto Rico total	Less than $15,000	$15,000 to $24,999	$25,000 to $34,999	$35,000 to $49,999	$50,000 or more
Don't need	31%	31%	24%	33%	34%	36%
No home computer	27%	33%	23%	17%	18%	2%
Expense	16%	18%	13%	17%	6%	0%

Thus, addressing the adoption gap will include affordability solutions, as well as addressing computer ownership and relevancy issues. However, despite these barriers, the ways that Puerto Rico residents use other forms of technology bodes well for the future of broadband adoption.

Most residents have a positive view of the benefits of new technology; they buy and use such technology, even though they have not purchased broadband. For example, according to the Puerto Rico Telecommunications Regulatory Board, approximately 48% of households have paid TV subscriptions and 97% have a color television set.[20] Additionally, research conducted by Connect Puerto Rico indicates that 62% of Puerto Rican adults own a cell phone.

C. Broadband Digital Inclusion Projects Underway Across Puerto Rico

There are many initiatives across Puerto Rico working to promote ICT adoption and close the digital divide. Some of the efforts bring people closer to computer technology, train how to use computer technology and navigate the Internet and encourage leveraging the network's power. Others focus on broadband accessibility, either by increasing penetration and/or making it more affordable. These initiatives are sponsored through public and private partnerships that include non-profit entities working to promote economic development across various regions of the island, private corporations in the IT sector, broadband providers, and national and local government agencies. In this section we highlight several examples of some of the more comprehensive and effective initiatives promoting digital inclusion across Puerto Rico. We also include a list of institutions providing digital resources and training across Puerto Rico communities.

1. Government-Sponsored Free Wi-Fi and Internet Access Centers

Puerto Rico Law 101, enacted July 28, 2010, mandates the Puerto Rico Telecommunications Regulatory Board (PRTRB) establish a Free Internet Access Center (FIAC) in each of the 78 municipalities of Puerto Rico in coordination with central government agencies, the municipalities themselves, and other private, educational, and community entities as deemed necessary. These Internet Access Centers will serve as public computer centers, making broadband access available to all citizens. These centers are specifically designed to provide "lifeline" access to the Internet for citizens who may not have access to the Internet through home, mobile or work connections.

The law also dictates that the PRTRB implements free wireless Internet access (fWi-Fi) in all public "plazas" of Puerto Rico. This free Wi-Fi access will allow all citizens to access the Internet at these central community locations, and generally promote Internet use across the community. The law authorizes the PRTRB to receive and administer funds from legislative appropriations, transfers, delegations, contributions and donations of any kind received from agencies, municipal governments, and the Government of the United States, as well as from individuals, NGOs, and other private entities for the design and implementation of projects, programs or services to be performed or offered in the FIACs. As of December 31, 2011, there were 33 fWi-Fi installation projects for public "plazas" and 46 FIACs.

Law 101-2010 mandates the Telecommunications Regulatory Board to establish Free Internet Access Centers in each of the 78 municipalities of Puerto Rico.

Connect Puerto Rico's 2010 Residential Technology Assessment confirms the value of these Internet access centers. While 15% of Puerto Rican laptop owners (or 5% of Puerto Rican residents) subscribe to a mobile wireless service that allows them to access the Internet on their laptop computer via a cellular network, nearly one-half of laptop owners (47%) utilize Wi-Fi "hot spot" zones to access the Internet; which is on par with laptop owners similarly surveyed by Connected Nation. Fifty percent of laptop owners surveyed by Connected Nation reported using wireless hotspots to access the Internet (Figure V.11).

When hot spot users were asked about the most popular places to access Wi-Fi, the results revealed an interesting landscape. Nineteen percent of wireless hotspot users living in the 13 jurisdictions surveyed by Connected Nation use outdoor public space for Internet access; across Puerto Rico, more than one-third (34%) of laptop computer owners visit an outdoor public space for Internet access. This suggests that Puerto Ricans seeking hot spots rely heavily on public spaces for Internet access. Furthermore, 70% of Puerto Rico laptop owners go to a restaurant or coffee shop for Internet access, compared to 60% across all jurisdictions surveyed by Connected Nation. In comparison to usage patterns in other U.S. jurisdictions surveyed by Connected Nation, Puerto Rico laptop owners are significantly less likely to go to a library, their employer, a hotel, or an airport for access to the Internet. Less than one-quarter (23%) of Puerto Rico laptop owners report going to the library for Internet access, 19% access hot spots at their place of employment, and 8% access hot spots at hotels or airports.

A convenient tool to promote hot spot usage would be an online map of all publically available hot spots across Puerto Rico. Such a map could include available resources both for free and for a fee. Useful data to ascertain the efficacy of these hot spots would include statistics on usage of the networks, number of patrons, and broadband capacity used.

Relative to their U.S. mainland counterparts, Puerto Rico laptop owners are significantly less likely to go to a library, their employer, a hotel, or an airport for access to the Internet.
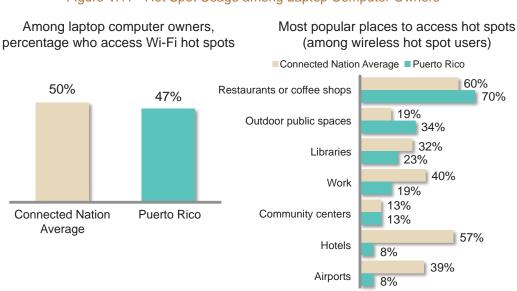
Figure V.11 - Hot Spot Usage among Laptop Computer Owners

Among laptop computer owners, percentage who access Wi-Fi hot spots

50% — Connected Nation Average
47% — Puerto Rico

Most popular places to access hot spots (among wireless hot spot users)

Connected Nation Average — Puerto Rico

Place	Connected Nation Average	Puerto Rico
Restaurants or coffee shops	60%	70%
Outdoor public spaces	19%	34%
Libraries	32%	23%
Work	40%	19%
Community centers	13%	13%
Hotels	57%	8%
Airports	39%	8%

2. Regional Economic Development Public-Private Partnership Promoting Broadband Infrastructure and Technology Use

Across Puerto Rico there are regional economic development initiatives that have embraced broadband and information technology as a key engine for economic growth. One example of such an initiative is INTECO (Iniciativa Tecnológica Centro Oriental), a nonprofit organization that promotes the economic development of the East-Central Region of Puerto Rico comprising the following municipalities: Cayey, Caguas, Gurabo, San Lorenzo, Juncos, Las Piedras, Naguabo, and Humacao. INTECO was created in 2003 and brings together local elected officials, higher education institutions present in the region, and corporate partners such as Microsoft.[21]

The Tecnológica Centro Oriental (INTECO) is a regional public-private partnership that aims to promote technology expansion in the region.

INTECO sponsors a series of initiatives aimed to promote technology expansion in the region. Key among these are its Centros de Innovación Tecnológica (CIT), or Center for Technology Innovation, which aims to promote innovation and growth through youth-oriented educational programs that focus on science, engineering, technology, and mathematics. The CITs were founded in 2004 with the expressed goal of promoting a culture for innovation and entrepreneurship and to bring ICT closer to the region's youth. There are currently three such centers located in the communities of Caguas, Cayey, and Juncos where ongoing training is offered in ICT and computer software skills, and entrepreneurship. Since its foundation, more than 60,000 citizens have benefited from these resources.[22] In partnership with the municipality of Caguas, INTECO also founded CIMATEC, a magnet high school specialized in sciences, mathematics, and technology. The CITs aim to expand the outreach of this educational initiative to youth beyond the municipality of Caguas.

In 2010, INTECO was awarded a $12.9 million grant from the U.S. Department of Commerce's National Telecommunications and Information Administration, and complemented by local investment totaling $3.4 million, to build a wireless backhaul broadband network in its focus region. To do so, it formed an alliance with the Puerto Rico Bridge Initiative to obtain Internet access at a reduced cost. This will enable INTECO to offer affordable broadband services on a wholesale basis to retail broadband providers across the region, significantly expanding the broadband capacity in the area and contributing to the competitive dynamics in the broadband sector. This broadband capacity expansion will serve to support the broadband needs of the CITs, among others. This project is currently underway with a Phase I go-live date of June, 2012.[23]

More recently, in early 2012, the Puerto Rico Industrial Development Company (PRIDCO) approved the allocation of $1.6 million to INTECO for the purpose of matching federal funds from the U.S. NTIA.[24] The goal of this funding is to expand Internet access in economically disadvantaged communities in the East Central region of the island and is expected to enable direct connection to 250 institutions; including schools, universities, hospitals, municipal buildings, and police stations. Additionally, INTECO expects this funding to facilitate broadband access to local customers, including 136,000 residents and 600 business and industrial sites. The project also includes Wi-Fi zones free of cost to promote Internet use among youth and economically disadvantaged adults.

Investments such as these, involving private and federal and local public resources, are the key to overcoming the digital lag across Puerto Rico's remote areas and spurring investment in outreach and training resources targeting vulnerable populations.

Leveraging the local library and K-12 institutions to promote digital learning is a key strategy to bridge the digital adoption gap.

3. Promoting ICT Use Across Public Libraries

Recognizing the important, new role of the public library as an Internet and technology hub for the community it serves, local leadership across Puerto Rico is taking action. One such example is the Vega-Alta municipality, which has funded a project to create a public computing center in the local library.[25] The goal of the initiative is to help close the digital divide in that community by creating a public computing center, offering broadband connectivity and specialized information resources to the community. The initiative brings together public and private partners including local public government, local schools, and community advocacy groups, and private citizens working together to create this new public resource. The public computing center was inaugurated in 2008 and since then has developed outreach and training programs targeting demographics with high risk of exclusion, such as single mothers, drug addicts, homeless, HIV+ patients, the elderly, people with physical disabilities, and school dropouts. Digital literacy training is provided to help citizens understand the relevance and use of broadband and related technology.

4. Leveraging Information Technology in the Classroom
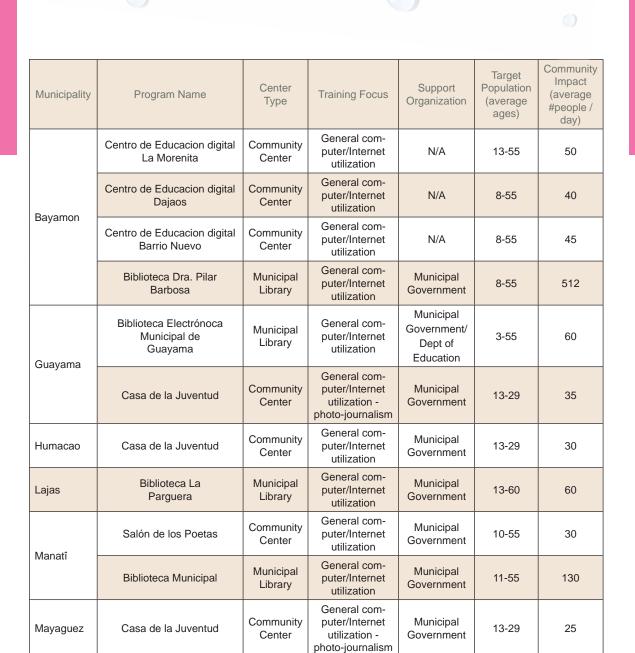
Intel Corporation and the Government of Puerto Rico have formed a public-private partnership to expand the scope of "Intel Teach" program to Puerto Rico, helping to bridge the digital gap by fully leveraging Information Technology in the classroom. The program is geared to improve teacher effectiveness through professional development, helping teachers integrate technology into their lessons, and promoting students' problem-solving, critical thinking, and collaboration skills. The main goal of the program is to increase access to technology in an effort to improve formative opportunities for the public school system, positioning them on more competitive footing in the shifting labor market. This public-private partnership was consolidated in January 2012 and is scheduled to provide training to approximately 21,000 public school teachers across Puerto Rico.

Puerto Rico's "Schools for the 21st Century" is a school modernization program that strives to improve the teaching and learning environments through addressing key design elements in each school.[26] One key element is integrating relevant education technology into the curriculum. School modernization would include ensuring high bandwidth broadband access, wireless access, increasing computer access in the library, providing two desktop computers in every room, integrating the use of electronic whiteboards, and providing access to other equipment such as digital cameras, video cameras, printers, and scanners as needed.

5. Other Programs Working to Bridge the Adoption Gap

Across Puerto Rico there exists 168 Centros Tecnologicos Comunitarios (CTC), or Community Technology Centers that were initially established via funding under a law for the integral development of the Special Communities of Puerto Rico, otherwise known as la Law Num. 1 of 2001 for "Comunidades Especiales." The objective for each CTC is to provide public computer access and training to all residents of disadvantaged communities throughout Puerto Rico. These disadvantaged communities were essentially defined by factors such as high unemployment rate, high percentage of population below the poverty level, and high percentage of school dropouts. Over time, the CTCs have been handed over for administration by the municipality, Department of Education, a public-private partnership or other entity and serve as a community resource.

Table V.1 - Programs Across Puerto Rico Working to Bridge the Adoption Gap						
Municipality	Program Name	Center Type	Training Focus	Support Organization	Target Population (average ages)	Community Impact (average #people / day)
Ceiba	Casa de la Juventud	Community Center	General computer/Internet utilization	Municipal Government	13-29	20
Caguas	Centro Criollo del Saber Bo. Borinquen	Community Center	General computer/Internet utilization	Municipal Government	Not Available	11
	Centro Criollo del Saber Bo. La Barra	Community Center	General computer/Internet utilization	Public/ Private Partnership	Not Available	32
	Centro Criollo del Saber Urb. Santa Elvira	Community Center	General computer/Internet utilization	Municipal Government	Not Available	57
	Centro Criollo del Saber Urb. Bairoa	Community Center	General computer/Internet utilization	Municipal Government	Not Available	36
	Centro Criollo del Saber Las Carolinas	Community Center	General computer/Internet utilization	Municipal Government	Not Available	6
	Biblioteca Pública Dr. Pedro Albizu Campos	Municipal Library	General computer/Internet utilization	Municipal Government	Not Available	46
	Centro Neurodigital Criollo	Community Center	General computer/Internet utilization	Public/ Private Partnership	Not Available	259
Barceloneta	Biblioteca Electrónica Municipal Sixto Electrónica	Municipal Library	General computer/Internet utilization	Public/ Private Partnership	10-20	200

Municipality	Program Name	Center Type	Training Focus	Support Organization	Target Population (average ages)	Community Impact (average #people / day)
Bayamon	Centro de Educacion digital La Morenita	Community Center	General computer/Internet utilization	N/A	13-55	50
	Centro de Educacion digital Dajaos	Community Center	General computer/Internet utilization	N/A	8-55	40
	Centro de Educacion digital Barrio Nuevo	Community Center	General computer/Internet utilization	N/A	8-55	45
	Biblioteca Dra. Pilar Barbosa	Municipal Library	General computer/Internet utilization	Municipal Government	8-55	512
Guayama	Biblioteca Electrónoca Municipal de Guayama	Municipal Library	General computer/Internet utilization	Municipal Government/ Dept of Education	3-55	60
	Casa de la Juventud	Community Center	General computer/Internet utilization - photo-journalism	Municipal Government	13-29	35
Humacao	Casa de la Juventud	Community Center	General computer/Internet utilization	Municipal Government	13-29	30
Lajas	Biblioteca La Parguera	Municipal Library	General computer/Internet utilization	Municipal Government	13-60	60
Manatî	Salón de los Poetas	Community Center	General computer/Internet utilization	Municipal Government	10-55	30
	Biblioteca Municipal	Municipal Library	General computer/Internet utilization	Municipal Government	11-55	130
Mayaguez	Casa de la Juventud	Community Center	General computer/Internet utilization - photo-journalism	Municipal Government	13-29	25

Municipality	Program Name	Center Type	Training Focus	Support Organization	Target Population (average ages)	Community Impact (average #people / day)
Orocovis	Centro Cibernético	Community Center	General computer/Internet utilization	Municipal Government	Starting at 12	80
	Unidad Móvil de Educación Tecnológica	N/A	General computer/Internet utilization	Municipal Government	Starting at 12	60
Rio Grande	Centro Cibernético	Community Center	General computer/Internet utilization	Public/ Private Partnership	Not Available	Not Available
San Juan	Casa de la Juventud	Community Center	17	Municipal Government	13-29	25
	Biblioteca Abelardo Díaz Alfaro	Municipal Library	General computer/Internet utilization	Municipal Government	Not Available	Not Available
	Biblioteca Electrónica Estudia Conmigo	Municipal Library	General computer/Internet utilization	Municipal Government	Not Available	Not Available
	Sala de Asistencia Tecnológica-Biblioteca Abelardo Díaz Alfaro	Municipal Library	General computer/Internet utilization	Municipal Government	People with disability and Elderly	Not Available
	Escuela Dr. Antonio S. Pedreira	School Facility	Non-traditional Education	Municipal Government	Not Available	Not Available
	Centros Tecnológicos Comunales in: Cupey, Las Monjas, Manuel A. Pérez, La Perla, Puerta de Tierra, Barrio Obrero, Bda. Figueroa, El Gandúl, Playita, Shangai, Campo Alegre, La Victoria, El Polvorín, La Marina, Villa Palmeras, Buen Consejo Jurutungo, Centro de Edad Avanzada de El Comandante, Centro de Educación Digital (PRT) en Río Piedras	Community Centers	General computer/ Internet utilization (some) Educational programs Outreach programs Photo-journalism	Municipal Government	Not Available	Not Available
Santa Isabel	Univ.del Este	University Facility	General computer/Internet utilization	Public/ Private Partnership	18-45	Not Available
Toa Alta	Biblioteca Municipal	Municipal Library	General computer/Internet utilization	Municipal Government	11-74	50%

Municipality	Program Name	Center Type	Training Focus	Support Organization	Target Population (average ages)	Community Impact (average #people / day)
Villalba	Centro Base Tecnología Informática	Community Center	General computer/Internet utilization	Public/ Private Partnership	12-40	100
	Centro Tecnología Informática Palmarejo	Community Center	General computer/Internet utilization	Oficina del Coordinador General para el Financiamiento Socio-económico y la Autogestión	11-50	15
	Centro Tecnología Informática El Semil	Community Center	General computer/Internet utilization	Oficina del Coordinador General para el Financiamiento Socio-económico y la Autogestión	8-45	8
	Centro Tecnología Informática Caonillas	Community Center	General computer/Internet utilization	Oficina del Coordinador General para el Financiamiento Socio-económico y la Autogestión	11-45	12
	Centro Tecnología Informática Tierra Santa (Casa de la Juventiud)	Community Center	General computer/Internet utilization	Municipal Government	13-29	30
	Centro Tecnología Informática Cerro Gordo	Community Center	General computer/Internet utilization	Oficina del Coordinador General para el Financiamiento Socio-económico y la Autogestión	10-20	7

D. Policy Recommendations to Promote Broadband Adoption

An examination of the broadband adoption and technology use across Puerto Rico reveals that there is a significant lag in the adoption and usage of broadband and IT across Puerto Rico. This lag is particularly acute across three demographic groups including: low-income residents, citizens with low levels of educational attainment, and senior citizens. Across these three groups, the core barriers to adoption are relevance of the benefits of the technology, affordability of the service and associated equipment, and sufficient digital literacy skills to be able to understand and use the technology.

Following the research and best practices of the federal government and other entities, including the Federal Communications Commission, and the Department of Commerce's BTOP Sustainable Adoption Grants, this Broadband Strategic Plan recommends the following normative recommendations for how to address these barriers across the most vulnerable populations in Puerto Rico.

1. Public Computing Capacity, Digital Literacy, and Workforce Development Programs

Puerto Rico private and public stakeholders should work together to leverage and expand public computing capacity across low-income communities. While the ultimate goal set in this Strategic Plan is to achieve universal adoption of broadband service across all households, establishing public computer centers in community centers, libraries, schools, churches or other community anchor institutions is an effective interim means to provide online access with limited resources and in short order to the maximum number of citizens.

In order for Puerto Rico non-adopters to find broadband valuable enough to subscribe, they need a basic knowledge of how to find and use substantive content. Digital literacy is an evolving concept. Though there is no standard definition, digital literacy generally refers to a variety of skills associated with using ICT to find, evaluate, create, and communicate information. According to the U.S. National Broadband Plan, it is the sum of the technical skills and cognitive skills people employ to use computers to retrieve information, interpret what they find, and judge the quality of that information.[27]

Researchers from the Social Science Research Council have found that community based organizations, such as libraries and non-profits, are key institutions in underserved and non-adopting communities – often providing Internet access, training, and support services even when those activities fall outside their traditional missions.[28] These organizations offer more than just free access to the Internet, they provide supportive environments for reluctant and new users to begin to explore the Internet, become comfortable using it, and develop the skills needed to find, utilize, and create content.[29] While the challenges and opportunities they face vary, these libraries and other community partners are critical to improving the digital proficiency in communities.[30] Table V.2 presents Puerto Rico's challenge. While Internet access at school and public community centers are comparable, only 3% of the Puerto Rico adults report accessing the Internet at the library, compared to 14% of all residents living in jurisdictions surveyed by Connected Nation.

Table V.2 - Where Residents Access the Internet		
Access Locations	**Connected Nation Average**	**Puerto Rico**
At home	77%	50%
Only access outside of home	10%	14%
At the library	14%	3%
At school	6%	7%
At a community center	2%	2%
No access at any location	14%	36%

Where else do Puerto Rican residents access the Internet? Eleven percent report accessing the Internet at someone else's home; which is significantly higher than the Connected Nation average. In fact, more Puerto Rico Internet users report accessing the Internet at a friend or family member's house than they do anywhere else besides their own home. This statistic appears to affirm conclusions drawn by a study by the Social Science Research Council. Using qualitative research techniques to examine broadband adoption and use in context, particularly in low-income communities, their research examined the role that community plays in supporting digital literacy: non-adopters and new users often rely on the assistance of others to get online or get one-on-one support when they use the Internet.

This important social dimension to broadband adoption cannot be overlooked. The primary incentive for broadband adoption is communication – two-way communication through e-mail, social networking platforms, instant messaging, or video-chatting.[31] People find broadband relevant when the communities they care about are online, exchanging information and creating content.[32] Once online, individuals will stay online if they continue to find information and broadband applications that are useful and relevant to their lives and when the people around them do the same.[33]

The 2010 Connect Puerto Rico Residential Technology Assessment indicates that one-third of all Puerto Rico broadband adopters first subscribed to broadband within twelve months of being interviewed for the assessment (compared to the 15% Connected Nation average). Furthermore, nearly one-half of low-income Puerto Rico broadband adopters began subscribing within twelve months of being interviewed (Figure V.12). To ensure sustainable adoption among these new-adopters, greater efforts will be needed to expand digital literacy training and learning opportunities across vulnerable communities. New adopters may be behind in learning how to generate and share content, use social networking sites, and find resources aimed at their own interests.

Ultimately, broadband adoption and utilization are not about owning a specific piece of technology or subscribing to a service but about providing individuals and communities with the tools to build assets, to participate in their communities, and to increase their education and healthcare opportunities. Getting Puerto Rico's residents online is a crucial first step, but the goal must be to keep people online through sustainable efforts that promote utilization and help each user derive value from the Internet in their own way.
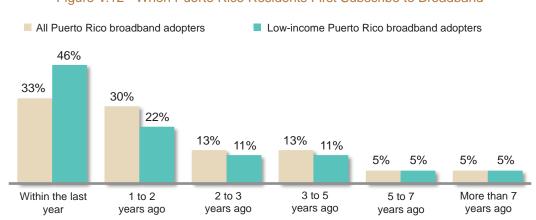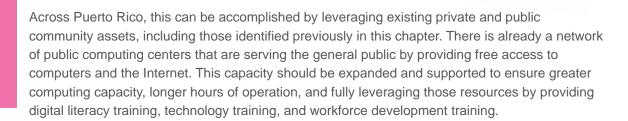
Figure V.12 - When Puerto Rico Residents First Subscribe to Broadband

■ All Puerto Rico broadband adopters   ■ Low-income Puerto Rico broadband adopters

	Within the last year	1 to 2 years ago	2 to 3 years ago	3 to 5 years ago	5 to 7 years ago	More than 7 years ago
All Puerto Rico broadband adopters	33%	30%	13%	13%	5%	5%
Low-income Puerto Rico broadband adopters	46%	22%	11%	11%	5%	5%

Across Puerto Rico, this can be accomplished by leveraging existing private and public community assets, including those identified previously in this chapter. There is already a network of public computing centers that are serving the general public by providing free access to computers and the Internet. This capacity should be expanded and supported to ensure greater computing capacity, longer hours of operation, and fully leveraging those resources by providing digital literacy training, technology training, and workforce development training.

The University of Puerto Rico (UPR) can also be an important resource to leverage. The eleven campuses of the UPR are distributed across the island and have the necessary facilities to support public computing centers of this kind. Unlike K-12 schools, which have financial limitations that curtail their hours of operation, facilities across the UPR campuses have the necessary electric, workforce, and safety infrastructure to support a public computing center serving the general population on a 24 hour basis. Furthermore, the student body could be leveraged to provide outreach and digital literacy. These volunteer activities could be incentivized by instituting participatory credit time for students willing to teach technology oriented courses to members of their community outside of the University system. Outreach to communities surrounding the campuses can be accomplished by tapping into some of the community centers identified in the previous section as well as tapping in to other NGOs such as Boys and Girls Clubs, Aspira, and Centro para Puerto Rico, among others. The existing UPR broadband capacity can be leveraged to maximize teaching resources by simultaneously streaming the course to other areas of the island.

To ensure the most effective use of these resources and adjust programs and curricula to ensure greater impact across the community, all of these institutions should track their progress. Data should be collected on an ongoing basis measuring the number of citizens impacted, the hours of computer and capacity used, and student participation in training programs. Students who attend training courses should be tested for general technical knowledge before and after each course. After course completion and submission of tests and survey information, a certification will be awarded. Graduates of various training courses could then be eligible for programs that promote broadband and IT adoption by providing discounted offers to computers, consumer devices, and/ or broadband service. A key metric that will need to be assessed is to what extent the training provided is encouraging broadband adoption in the home or via a personal mobile connection.

Mobile broadband is an effective and more affordable way to encourage participation in the Internet economy.

Leveraging ARRA funds, the U.S. Department of Commerce was able to fund a series of programs expanding Public Computing Centers and offering Digital Literacy plans at the local level under the Broadband Technology Opportunities Program (BTOP). One successful example of such programs is Every Citizen Online, a program managed by the non-profit Connect Ohio. The program brings together over 245 locations throughout the state, where BTOP resources were used to expand public computing capacity and facilitate a new and broader curriculum for digital training. The program is complemented with a traditional media outreach campaign targeting all citizens who have yet to adopt broadband usage. For more information on this program see http://connectohio.org/every-citizen-online

2. Mobile Broadband Usage

While the ultimate goal set by this Strategic Plan is to ensure that all Puerto Ricans have multiple access points to the Internet – in their schools, community institutions, places of work, homes, and in their pockets – so that they can fully leverage the power of online resources, promoting mobile broadband across low income segments of the population is an effective and more affordable way to encourage participation in the Internet economy.

Today, mobile smartphone devices and mobile tablets tend to cost less than desktop or laptop computers, especially if commercial offerings include financing for the customer device. Further, digital skills necessary to explore online resources are relatively easier to overcome through mobile devices than using more traditional computer technologies; and mobile broadband bundles that complement voice offers are generally less costly than home broadband options, making mobile broadband more affordable. In short, with lower barriers to adoption, mobile broadband solutions are fast becoming a key anchor to bring the disconnected online.
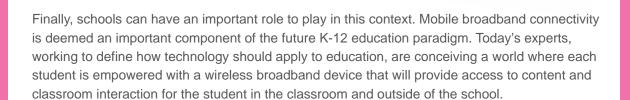
Mobile broadband service is often utilized as a complementary tool to access the Internet, rather than a substitute for fixed broadband access through a desktop or laptop computer. For the most part, broadband-connected individuals view mobile devices as an extension of their home broadband subscription; providing an additional, convenient, and portable access method. Thus, while mobile broadband empowers a low-cost alternative to online access, substituting mobile for fixed access can offer limitations – at least given today's technology. For example, they are not necessarily the appropriate means to research and write a term paper, or prepare and present a job application. Nonetheless, mobile broadband devices do offer a plethora of applications and usages that empower the user to take advantage of the online world. Further, mobile broadband service can be an effective conduit for previously disconnected citizens to start learning how to leverage online resources and become a bridge technology that may eventually be complemented with other forms of access to the Internet economy. Hence, promoting mobile broadband adoption to all citizens, particularly low income Puerto Ricans, can be the fastest means to overcome some of the key barriers to broadband adoption; including affordability of devices and service, relevance of the technology, and digital literacy limitations.[34] Puerto Rico's private and public stakeholders should work together to ensure that these opportunities are appropriately targeted across the more vulnerable populations.

The mobile broadband market in Puerto Rico is characterized by a healthy degree of competition, which has resulted in high mobile coverage penetration.[35] As mobile providers roll out their 4G service, it is important that low-income neighborhoods are not forgotten. The establishment of a public-private partnership to ensure that low-income communities are targeted by 4G build-out should be encouraged.

Further, efforts should be considered that would help reduce the cost of the service for low-income households. Pre-paid pricing packages for mobile voice services have proven to be a very effective marketing strategy to encourage low income citizens to adopt this technology. Mobile broadband providers should explore similar marketing strategies and other a la cart mobile broadband packages offering price-sensitive customers greater flexibility.

To complement such a strategy, efforts should be focused to help lower mobile broadband price points for low income populations. The FCC's Low Income Broadband Pilot program has this objective in mind. The pilot program will provide subsidies to low-income households for their broadband service. This pilot is expected to include projects targeting low-income households that use mobile broadband platforms, as well as fixed broadband platforms. Puerto Rico mobile providers should take advantage of this opportunity and work with the FCC to test the best means to leverage such programs across Puerto Rico.

Finally, schools can have an important role to play in this context. Mobile broadband connectivity is deemed an important component of the future K-12 education paradigm. Today's experts, working to define how technology should apply to education, are conceiving a world where each student is empowered with a wireless broadband device that will provide access to content and classroom interaction for the student in the classroom and outside of the school.

The FCC is currently implementing a pilot program to test how to best to implement this vision called Learning On-The-Go, which provides subsidies to finance a device for each student and financed the mobile broadband connection across 20 schools in the U.S.[36] This model, currently being assessed by education experts, would have a tremendous impact on rapidly helping to close the digital divide. Students under such a model will learn early on how to leverage the opportunities available to them online. As they do so, they will be able to teach their elders how to leverage these resources to advance their education, apply for a job, or otherwise look for opportunities enabled by the Internet.
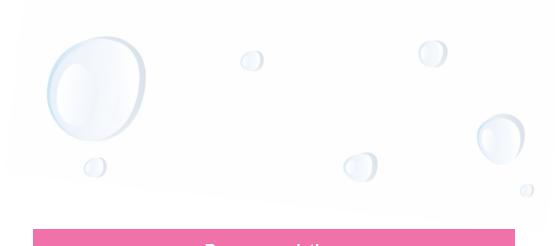
> **Recommendation**:
> Aggressively promote mobile broadband usage, especially among low income and vulnerable populations, as an effective lower-cost and easier to access introduction to online resources.

3. Online Digital Literacy Curricula

There are multiple public, non-profit, and corporate portals that offer digital literacy training and work force development resources associated with ICT. Puerto Rico stakeholders should leverage these online resources to bring solutions to non-adopting citizens and communities. Examples of such public and private online portals abound, including the following:

- National Telecommunications & Information Administration digital literacy portal http://www.digitalliteracy.gov/
- Goodwill Community Foundation International online educational portal in English http://www.gcflearnfree.org/ and Spanish http://www.gcflatino.org/
- Aspira-Thinkfinity online educational content http://www.aspira.org/en/manuals/thinkfinity and online Youth Development Curriculum http://www.aspira.org/en/curriculo-para-el-desarrollo-de-liderazgo-en-la-juventud
- Connect Ohio, Every Citizen Online digital training portal - http://training.connectednation.org/landing?lang=es

4. Awareness and Outreach Campaign Showcasing the Benefits of Broadband

The private sector and non-profit community should partner to conduct an outreach and awareness campaign across Puerto Rico, aimed to showcase the benefits of broadband and online resources to citizens across the most vulnerable segments of society. Such outreach can be achieved through targeted marketing campaigns and Public Service Announcements aimed at showcasing the many benefits of broadband and the Internet to at-risk populations. Public and private partners should prioritize efforts to increase the relevance of broadband for low-income citizens as well as people with disabilities and older Puerto Ricans. Awareness and outreach plans should be customized to the targeted population. One size fits all will not work. Rather, each target audience needs to be addressed with particular, relevant messages, through the medium that conveys that message best.

Traditional media can be used for this purpose, as well as new tools that leverage popular commercial and TV outlets in Puerto Rico. For example, a network of booths providing live video streaming services in public institutions, such as safe commercial shopping malls and other public venues, can be used to raise awareness of the power of broadband. By interconnecting these public live video streaming venues, disparate points across the island could be virtually connected providing patrons free, real time connections with people in other parts of the island. As such, Vieques could become virtually connected with the center of San Juan, Ponce and beyond, allowing friends and family, or simply passersby to experience the power of broadband. Fully leveraged, this project could become an effective media tool to carry the message of the benefits broadband affords to the average Puerto Rico citizen. This momentum can be used to send a "connect to broadband" message to everyone.
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Recommendation:
Launch public-private targeted awareness campaigns promoting the benefits of online resources across vulnerable populations.

Teleworking is a broadband-enabled solution benefiting both workers and employers and driving broadband expansion.

5. Promote Telework Across Puerto Rico Private and Public Sectors

Teleworking is a powerful example of the way broadband can affect our lives. Yet, across Puerto Rico teleworking is not a common practice. Connect Puerto Rico Business Technology Assessment Survey estimates that in Puerto Rico only 4% of employed adults report that they telework and 43% claim they would telework if allowed.[37] This suggests that there is great room for growth in teleworking across Puerto Rico. Important benefits can come to Puerto Rico through broadband-enabled telecommuting, including environmental benefits through reduction of the carbon footprint generated by commuting automobile traffic, reduction in commuting time and traffic congestion, or reduced need for office space and associated costs, such as electric power and water. Certain professions are natural fits for teleworking, and therefore enhanced productivity, such as statisticians, case workers, software developers, auditors, university students, and teachers.

Puerto Rico can accelerate the adoption of telecommuting practices by revising labor laws and policies that could be hindering the private and public sectors from allowing teleworking to become common practice. Further, as a key employer across the island, the Government of Puerto Rico can have an important impact on broadband usage and adoption by promoting teleworking practices throughout its workforce.

> **Recommendation**:
> Promote telework across Puerto Rico by revising labor laws and policies hindering its growth, and setting in motion plans to expand teleworking practices through the Puerto Rico government.

6. Leverage the Presence and Value of eGovernment Services

The government of Puerto Rico has invested heavily in developing online platforms through pr.gov supported services that provide to citizens, businesses, and other institutions access to government-related information and services. The digitalization of government-citizen transactions is important for Puerto Rico because it results in significant budgetary savings by lowering the cost of conducting business. Just as importantly, the expansion of eGovernment services across all levels of the Puerto Rico government structure will increase the value of the net to all Puerto Rico citizens and businesses, encouraging usage and access to the technology. Hence, accelerated expansion of the pr.gov portal is needed.

The power of eGovernment can also be leveraged by encouraging online citizen-government transactions in lieu of traditional means. Examples of such incentives include:

- Facilitate and eventually require that citizens apply for subsidized government services (public housing, educational, transportation, electricity, food, healthcare, etc.) electronically, via a broadband connection in their home, a public computing center, or in the government office itself.
- Encourage enrollment in local community digital literacy training centers for those citizens lacking basic IT skills.
- Offer a deduction or other benefits to citizens filing local and Puerto Rico taxes online.

Recommendation:
Leverage the presence and value of eGovernment services.

7. ICT Access and Use in the Classroom

As is discussed in Chapter VI of this Strategic Plan, the K-12 educational experience is a critical factor in overcoming the digital divide across Puerto Rico. It is imperative that the educational experience of Puerto Rico children today is adapted to fully leverage the IT and broadband technology of the twenty-first century in order to prepare Puerto Rico's future leaders, employment force, innovators and creators to compete and succeed in the global economy. It is imperative, therefore, that we overhaul and reinvent Puerto Rico's K-12 curriculum to ensure that broadband and online resources are fully leveraged to support student needs, and that graduates of the system have the necessary skills to succeed in the twenty-first century. We discuss in detail the goals and process of such transformation in Chapter VI. However, it is important to note that this transformation will be an essential strategy to quickly and effectively overcome the technology adoption gap across Puerto Rico.

Recommendation:
Accelerate ICT access and use in the K-12 classroom.

8. Promote Broadband Adoption Among Low Income Populations

Research shows that affordability of broadband services and associated computer or device equipment is a key barrier to broadband and technology adoption and usage, particularly across low income segments of the society. In order to overcome this barrier to adoption, efforts need to be made to lower the price point of the service and access technology to at-risk populations. This can be achieved through subsidies offered to targeted demographic groups providing discount for broadband service and/or IT equipment. These subsidies can be achieved if broadband providers and IT equipment vendors work in partnership with federal and Puerto Rico government resources. In particular, the private sector in partnership with public agencies including the Public Housing Authority, the Special Communities Administration, the Department of Labor, Economic Development, and the Department of Family Affairs should work together to establish programs geared to the most vulnerable across Puerto Rico offering basic entry broadband service at discounted prices.

An opportunity to complement these efforts exists through the FCC Low Income Broadband Pilot program, which is to be implemented in 2012. As part of the overall reform of the Low Income component of the Universal Service Fund (USF) program, the FCC is evaluating how to expand this program to include subsidies to low income households for broadband service.

The Lifeline USF program currently subsidizes voice-telephony services for households with earnings below a certain income benchmark across the entire nation. These subsidies are meant to ensure that all citizens, regardless of income, have access to the voice-telephony service. Puerto Rico low income citizens have directly benefited from this program in the past. In 2010, approximately $40 million was disbursed in Puerto Rico through this program.[38] The National Broadband Plan released by the FCC in 2010 called for the expansion of these subsidies to include broadband.[39] To achieve this goal, the FCC is implementing a pilot program aimed to test various policy options and obtain research information that can inform how best to structure a Low Income subsidy program for broadband service across the entire nation.[40]

The FCC has allocated a total of $25 million to fund a series of pilot programs across the nation in 2012. These funds will finance the administrative and research expenses associated with the pilot programs and provide the subsidy necessary to achieve a discount broadband offer to the targeted population. The discounted service will be available to households with income earnings below the income benchmark that currently applies for the Low Income, Lifeline subsidy program.

Broadband providers are encouraged to apply for this program and offer innovative models for how to effectively overcome the adoption barriers to broadband usage across low income demographics. The FCC is encouraging broadband provider applicants to include as part of their offering key components that will help overcome such barriers including a local digital literacy plan that will provide digital literacy and workforce development training, online digital literacy curricula, and a discounted offer for computer, notebook, or tablet devices.

The FCC encourages broadband providers applying to the pilot program to partner with third parties succeeding in overcoming these barriers to adoption. In particular, the FCC encourages providers applying to the pilot program to partner with "successful BTOP/BIP grantees, those involved in "Connect to Compete," existing library programs or other entities currently providing broadband adoption and education services to low-income consumers in order to develop pilot projects that integrate federal universal service support into existing or planned adoption efforts."[41]

The Puerto Rico Broadband Taskforce strongly encourages multiple applications to this pilot program from various Puerto Rico stakeholders. To achieve this goal, the Puerto Rico Broadband Taskforce, in association with Connect Puerto Rico, is conducting educational outreach to key stakeholders regarding these pilot programs, and is working to encourage partnerships to support innovative and effective pilot applications. The expected time frame for submission of these applications will be in Q2 of 2012.
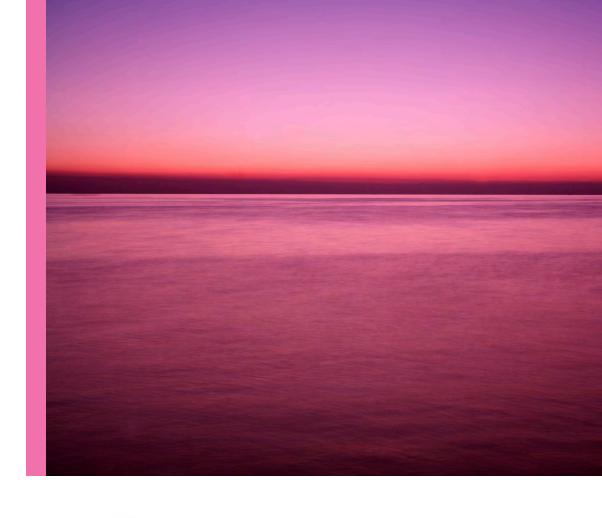
Beyond this important opportunity to help achieve discount offerings for broadband services to low-income households across Puerto Rico, the PR Broadband Taskforce will continue to research and encourage other models that will bring together private and public resources to effectively overcome the affordability challenge for broadband adoption across Puerto Rico.

Recommendation:
The private sector in partnership with public agencies including the Public Housing Authority, the Special Communities Administration, the Department of Labor, Economic Development, and the Department of Family Affairs should work to establish programs offering basic entry broadband service at discounted prices to the most vulnerable citizens in Puerto Rico.

Recommendation:
Work collaboratively with federal agencies to promote broadband adoption among low income populations.

Endnotes

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Note: This report indicates that U.S. broadband adoption rate is 68%. According to the National Broadband Plan, 98.9% of U.S. households have broadband available at basic speeds of 768 kbps download/200 Kbps upload (http://www.broadbandmap.gov/)

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Note: In this report, mobile broadband access can be defined as a subscription to a mobile wireless service via a laptop, access to Wi-Fi service via a laptop, or the ability to access to the Internet via a cellphone, or other mobile device.

[11] Smith, A. Pew Internet & the American Life Project. (2010). *Mobile access 2010*. Retrieved from website: http://www.pewinternet.org/Reports/2010/Mobile-Access-2010/Summary-of-Findings/Findings.aspx
Note: Pew defines mobile access who access to the Internet via Wi-Fi or a mobile broadband Internet connection through a laptop, or the use of the Internet, email, or instant messaging via a cellphone. The results in this survey are based on data from telephone interview conducted by Princeton Survey Research Associates International between April 29 and May 30, 2010, among a sample of 2,252 adults, age 18 and older. For results based on the total sample, one can say with 95% confidence that the error attributable to sampling and other random effects is $\pm$ 2.4%.

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[34] Ibid.

[35] See Section B (*The Puerto Rico Adoption Gap in Detail*) of this chapter for an overview of Puerto Rico's mobile broadband adoption.

[36] See Chapter III of this Strategic Plan for an overview of the broadband inventory across Puerto Rico, including mobile coverage.

[37] Federal Communications Commission, (2011). *E-rate deployed ubiquitously 2011 pilot program.* Retrieved from website: http://www.fundsforlearning.com/docs/2011/07/DA-11-1181A1.pdf
Note: For more information on this pilot program.

[38] Federal Communications Commission, (2012). *Lifeline program for low-income consumers.* Retrieved from website: http://www.fcc.gov/encyclopedia/lifeline-program-low-income-consumers

[39] Federal Communications Commission. (2010). *National Broadband Plan.* Retrieved from website: http://www.broadband.gov/plan/9-adoption-and-utilization/

[40] Federal Communications Commission, (2012). *Lifeline reform order.* Retrieved from website: http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db0207/FCC-12-11A1.pdf

[41] Federal Communications Commission, (2012). *Lifeline reform order*, p. 169. Retrieved from website: http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db0207/FCC-12-11A1.pdf